

emissions reduction' scenarios, although by 2016 the impacts are likely to be closer to the 'without reduction' results than the 'with reduction' results.

PM₁₀ and PM_{2.5}

- 5.7 The annual mean PM₁₀ and PM_{2.5} concentrations are well below the annual mean objectives at all receptors, with or without the scheme. Furthermore, as the annual mean PM₁₀ concentrations are below 32 µg/m³, it is unlikely that the 24-hour mean PM₁₀ objective will be exceeded at any of the receptors.
- 5.8 The percentage changes in both PM₁₀ and PM_{2.5} concentrations, relative to the air quality objective (when rounded), are predicted to be zero at all of the receptors. Using the matrix in Table A3.1 (Appendix A3), these impacts are described as *negligible*.

Operational Dust Impacts

Plant Design

- 5.1 The proposed concrete batching plant will produce concrete for the THFC development until 2017. In that time, it is anticipated that 65,000 m³ of concrete will be produced.
- 5.2 Concrete will be produced from the following raw materials, and they will be stored on site as follows:
- cement – stored in sealed silos;
 - GGBS – stored in sealed silos;
 - limestone fines – stored in sealed silos;
 - fine and coarse aggregates – stored in ground bays; and
 - water and admixture – stored in tanks.
- 5.3 The facility will receive all raw materials by road vehicle, except for water which will be pumped to the site via pipes. It is anticipated that a total of 80,000 m³ of aggregate will be required, which will be delivered in 20 tonne (11.11 m³) wagons. Aggregate is primarily made up of large grains that will not be susceptible to suspension in air, although it will undoubtedly contain some smaller particles that could become airborne. However, by the time the aggregate reaches the proposed development, it will have been handled a number of times, and thus many of these smaller particles will already have been removed. Furthermore, all conveyors at the facility used to transfer aggregate will be fitted with wind-boards to prevent wind-whipping of the aggregate; this mitigation measure is consistent with the best available techniques detailed in the Defra guidance (Defra, 2012). It will also be ensured that drop-heights of aggregates are minimised as far as possible.

- 5.4 The concrete production process is a "fully wet" batch process. Aggregates will be fed into the batching plant from the ground bays using a front-end loader, and then fed into the static mixer. The aggregate bays will be built so that aggregate is all stored below the level of the walls encompassing the bays, minimising the amount of wind passing over the stockpiles; this mitigation measure is consistent with the best available techniques detailed in the Defra guidance (Defra, 2012).
- 5.5 Cement deliveries will take place through a fully enclosed system, whereby cement powder is extracted from the delivering HGV tankers into storage silos using compressed air, generating minimal dust emissions. The silos will be fitted with dust filters and high-level and pressure sensor alarms (warning light and siren) linked to automatic shut-off valves on the fill pipe, and are thus considered to be consistent with the best available techniques detailed in the Defra guidance (Defra, 2012). From the silos, the cement will then be screwed into a weigh-hopper and then discharged into a static mixer.
- 5.6 Water and admixture will then be weighed and added to the static mixer. The final wet concrete will then be discharged into mixer trucks for transportation to the main development site. This liquid concrete will not generate any dust.
- 5.7 It is understood that the site will be paved, with no unpaved ground over which HGVs can travel. Coupled with the low dust emission potential of the on-site process, it is unlikely that dust and dirt will be tracked out onto the local roads. Nevertheless, a road-sweeper will be utilised at the site, which is considered a suitable alternative to a wheel-wash system as suggested in the Defra guidance (Defra, 2012).
- 5.8 In summary, the facility will be designed to include all of the control technology necessary to ensure that dust emissions are kept to an absolute minimum, following the best available techniques outlined in Defra's Statutory Guidance for Blending, Packing, Loading, Unloading and Use of Cement (Defra, 2012). The plant will also adhere to all of the particulate matter emission limits set out in the guidance document.

Potential for Dust Impacts

- 5.9 This section considers the dust generation potential of the proposed development, and the likelihood that the dust generated will lead to impacts at the nearest sensitive receptors. The nearest residential properties to the site boundary lie approximately 26 m to the south of the site.
- 5.10 In adapting and using the IAQM's construction dust assessment methodology (Institute of Air Quality Management, 2014) (see Appendix A2 for further details), the first step is to screen the need for an assessment. There are no sensitive ecological sites within 50 m of the proposed development, and thus there is no requirement for an assessment of the impacts of dust emissions

on nearby ecological sites. However, there are sensitive human receptors within 350 m of the site boundary, and thus the potential for impacts upon these receptors requires assessment.

- 5.11 The next step is to consider the potential dust emission magnitude of the site. Given that the site will be built to incorporate the necessary best available techniques for dust emission abatement, as outlined above, it is considered appropriate to assume that, in comparison to a typical construction site, the dust emission magnitude of the proposed development will be 'small'.
- 5.12 The next step is to define the sensitivity of the area. There are estimated to be more than 100 residential buildings within 100 m of the site boundary. Using the matrix in Table A2.3, the area surrounding the onsite works is currently of 'medium' sensitivity to dust soiling effects.
- 5.13 The matrix in Table A2.4 requires information on the baseline annual mean PM₁₀ concentration in the area. It is considered that the existing annual mean PM₁₀ concentration is best described by the background concentration from Table 4. Using the matrix in Table A2.4, the area surrounding the onsite works is of 'low' sensitivity to human health effects.
- 5.14 The risk of impacts can now be defined, using the dust emission magnitude and area sensitivities outlined above. Using the matrix applicable to demolition in Table A2.6, which is the most conservative, the risk of impacts would be defined as 'Negligible' in terms of human health impacts, and 'Low Risk' in terms of dust soiling impacts. Given the cautious approach of this assessment, and considering the processes used and abatement measures already in place, it is considered highly unlikely that the proposed facility will lead to significant dust impacts at any nearby sensitive receptors.

Significance of Traffic Air Quality Impacts

- 5.15 The local air quality impacts of the construction compound related traffic, without mitigation, are judged to be *significant*. This professional judgement is made in accordance with the methodology set out in Appendix A3, and also takes into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. The latter has been addressed by giving consideration to both sets of modelled results for nitrogen dioxide; those with and without reductions in traffic emissions. It is expected that concentrations will fall in the range between the two sets of results, although by 2016 the impacts are likely to be closer to the 'without reduction' results than the 'with reduction' results.
- 5.16 More specifically, the judgement that the air quality impacts of the construction compound will be *significant* without mitigation takes account of the assessment that concentrations are predicted to remain above the objective at the majority of the receptor locations, and the impacts, while mostly negligible, will be moderate adverse at a number of receptors, in particular along White Hart Lane.
- 5.17 While this assessment has focused on those areas where adverse impacts are expected, it is noted that overall the scheme will reduce the distance over which concrete mixer trucks will have

to travel across the borough. It is thus likely that there will be beneficial air quality impacts over the wider area. Furthermore, the impacts will be temporary with the batching plant operation ceasing in 2017, and thus the impacts will be eliminated following decommissioning of the plant.

6 Mitigation

Road Traffic Impacts

- 6.1 The assessment has demonstrated that the scheme will not cause any exceedences of the air quality objectives in areas where they are not currently exceeded. Furthermore, any impacts will be both localised and temporary. The construction related traffic is expected to conform to the Euro VI emission standards. This will reduce the impacts below those set out above. It is not considered essential to provide any additional mitigation. It may be possible to minimise the impacts by using hybrid or electric vehicles to transport the concrete from the construction site to the THFC development site. The feasibility of this is unknown and would need to be investigated; electric HGVs for movement of concrete may not be available commercially.

Operational Dust Impacts

- 6.2 The proposed development will operate to the strict best available techniques outlined in the Defra guidance (Defra, 2012). These include a range of measures to ensure that there are no significant releases to air. It is anticipated that these measures will be sufficient to ensure that the proposed development has a negligible impact on sensitive receptors in the local area. It is thus not considered necessary to propose further mitigation.

7 Conclusions

- 7.1 The proposed compound will include a number of abatement measures that will ensure that there are no significant emissions to air of dust or particulate matter. The site will need to be approved by the Local Authority, who will be able to ensure that the abatement measures are adequate, and that they are suitably maintained, so as to ensure no adverse impacts on nearby sensitive receptors. The proposed development will adhere to the statutory guidance (Defra, 2012) on blending, packing, loading, unloading and use of cement issued by Defra, and it can thus be assumed that the site will not generate any significant dust emissions.
- 7.2 The localised adverse impacts of increased traffic emissions on White Hart Lane and High Road south of White Hart Lane, along with the small beneficial impacts along High Road north of White Hart Lane, due to decreases in THFC construction traffic, have been assessed. Concentrations have been modelled for 19 worst-case receptors, representing existing properties where impacts are expected to be greatest. In the case of nitrogen dioxide, the modelling has been carried out assuming both that vehicle emissions decrease (using 'official' emission factors), and that they do not decrease in future years. This is to allow for uncertainty over emission factors for nitrogen oxides identified by Defra (Carslaw et al., 2011).
- 7.3 It is concluded that concentrations of PM₁₀ and PM_{2.5} will remain below the objectives at all existing receptors in 2016, whether the construction compound is utilised or not. This conclusion is consistent with the outcomes of the reviews and assessments prepared by the LB of Haringey, which show that exceedences of the PM₁₀ objective are unlikely at any location.
- 7.4 In the case of nitrogen dioxide, the annual mean concentrations will remain above the objective at 16 of the 19 existing receptors in 2016, whether the construction compound is utilised or not, and whether or not a reduction in vehicle emissions of nitrogen oxides is assumed.
- 7.5 The maximum daily average construction related traffic for the THFC site (assuming no construction compound) on High Road, of 41 HGVs, leads to a moderate adverse impact at locations along High Road. Use of the construction compound will lead to a small reduction in HGV movements along High Road north of White Hart Lane; this is unlikely, however, to remove the moderate adverse impacts. The additional traffic along White Hart Lane will introduce new adverse impacts along this road.
- 7.6 The traffic generated by the proposed development will affect air quality at existing properties along the local road network. The assessment has demonstrated that the changes in concentrations of PM₁₀ and PM_{2.5} at relevant locations relative to the objectives will be 0% (when rounded) and the impacts will all be *negligible*. In the case of nitrogen dioxide, the percentage changes are predicted to range from 0% to 1%, and the impacts will range from *negligible* to *moderate adverse*. The duration of any impacts will be short, since the scheme is only temporary.

It should be noted that there are some reductions in concentrations in areas along High Road north of White Hart Lane (Receptors 13-16), although these are rounded to 0% and therefore not significant reductions. It should also be noted that the impacts detailed in this report are not those of the construction related traffic for the THFC development. They are the comparison of the situation without the construction compound versus that with the construction compound. The localised adverse impacts of the development relative to there being no construction compound are judged to be *significant*. This conclusion, which takes account of the uncertainties in future projections, in particular for nitrogen dioxide, is based on the anticipated duration of the impacts, and the fact that the scheme will not cause any exceedences of any objective in areas where they are not already exceeded.

- 7.7 While this assessment has focused on those areas where adverse impacts are expected due to the use of the construction compound, it is noted that overall the scheme will reduce the distance over which concrete mixer trucks will have to travel across the borough. It is thus likely that there will be beneficial air quality impacts over the wider area.

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9 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LB	London Borough
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
µg/m³	Microgrammes per cubic metre
MAQS	Mayor's Air Quality Strategy
NRMM	Non-road Mobile Machinery
NO	Nitric oxide
NO₂	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO ₂ + NO)

NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM₁₀	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
PM_{2.5}	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
SPG	Supplementary Planning Guidance
SPD	Supplementary Planning Document
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
ULEZ	Ultra Low Emission Zone

10 Appendices

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A1 London-Specific Policies and Measures

London Plan

A1.1 The London Plan sets out the following points in relation to planning decisions:

"Development proposals should:

- a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs or where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3);*
- b) promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils "The control, of dust and emissions form construction and demolition";*
- c) be at least "air quality neutral" and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs));*
- d) ensure that where provision needs to made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches;*
- e) where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."*

The Mayor's Air Quality Strategy

A1.2 The Mayor's Air Quality Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures, including:

Policy 1 – Encouraging smarter choices and sustainable travel;

Measures to reduce emissions from idling vehicles focusing on buses, taxis, coaches, taxis, PHVs and delivery vehicles;

Using spatial planning powers to support a shift to public transport;

Supporting car free developments.

Policy 2 – Promoting technological change and cleaner vehicles:

Supporting the uptake of cleaner vehicles.

Policy 4 – Reducing emissions from public transport:

Introducing age limits for taxis and PHVs.

Policy 5 – Schemes that control emissions to air:

Implementing Phases 3 and 4 of the LEZ from January 2012

Introducing a NOx emissions standard (Euro IV) into the LEZ for Heavy Goods Vehicles (HGVs), buses and coaches, from 2015.

Policy 7 – Using the planning process to improve air quality:

Minimising increased exposure to poor air quality, particularly within AQMAs or where a development is likely to be used by a large number of people who are particularly vulnerable to air quality;

Ensuring air quality benefits are realised through planning conditions and section 106 agreements and Community Infrastructure Levy.

Policy 8 – Creating opportunities between low to zero carbon energy supply for London and air quality impacts:

Applying emissions limits for biomass boilers across London;

Requiring an emissions assessment to be included at the planning application stage.

Low Emission Zone (LEZ)

- A1.3 A key measure to improve air quality in Greater London is the Low Emission Zone (LEZ). This entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects older, diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. The LEZ was introduced on 4th February 2008, and was phased in through to January 2012. From January 2012 a standard of Euro IV was implemented for lorries and other specialist diesel vehicles over 3.5 tonnes, and buses and coaches over 5 tonnes. Cars and lighter Light Goods Vehicles (LGVs) are excluded. The third phase of the LEZ, which applies to larger vans, minibuses and other specialist diesel vehicles, was also implemented in January 2012. As set out in the 2010 MAQS, a NOx emissions standard (Euro IV) is included in the LEZ for HGVs, buses and coaches, from 2015.

Ultra Low Emission Zone (ULEZ)

- A1.4 The Mayor has confirmed the introduction of the Ultra Low Emission Zone (ULEZ) in the Capital on 7 September 2020. The ULEZ will operate 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches.

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM, upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM explains that this classification should be based on professional judgement, but provides the examples in Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m ³ , potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m ³ – 50,000 m ³ , potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m ² , potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m ² – 10,000 m ² , moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m ² , soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m ³ , piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m ³ – 100,000 m ³ , potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout ^a	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

^a These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM₁₀, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided by the IAQM has been used as the basis for the requirements set out in Appendix A6.

STEP 4: Determine Significant Effects

A2.12 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (Institute of Air Quality Management, 2014).

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM₁₀		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM ₁₀
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Effects on People and Property from Dust Soiling ⁴

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Low	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A2.4: Sensitivity of the Area to Human Health Effects ⁴

Receptor Sensitivity	Annual Mean PM ₁₀	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

⁴ For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.5: Sensitivity of the Area to Ecological Effects ⁴

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A3 EPUK & IAQM Planning for Air Quality Guidance

A3.1 The guidance issued by EPUK and IAQM⁵ (EPUK & IAQM, 2015) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air quality as a material consideration

“Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- the severity of the impacts on air quality;*
- the air quality in the area surrounding the proposed development;*
- the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- the positive benefits provided through other material considerations”.*
-

Screening

Impacts of the Local Area on the Development

“There may be a requirement to carry out an air quality assessment for the impacts of the local area’s emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development”.*

⁵ The IAQM is the professional body for air quality practitioners in the UK.

Impacts of the Development on the Local Area

A3.2 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the follow apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use;
- more than 1,000 m² of floor space for all other uses or a site area greater than 1 ha.

A3.3 Coupled with any of the following:

- the development has more than 10 parking spaces;
- the development will have a centralised energy facility or other centralised combustion process.

A3.4 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, the criteria for which are set out below. The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria is likely to be more appropriate.

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor;
- the development will have one or more substantial combustion processes where the combustion unit is:
 - any centralised plant using bio fuel;

- any combustion plant with single or combined thermal input >300 kW; or
- a standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year).
- the development will have a combustion unit of any size where emissions are at a height that may give rise to impacts through insufficient dispersion, e.g. through nearby buildings.

A3.5 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area.

A3.6 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Impact Descriptors and Assessment of Significance

A3.7 There is no official guidance in the UK on how to describe the nature of air quality impacts, nor how to assess their significance. The approach developed by EPUK and IAQM⁶ (EPUK & IAQM, 2015) has therefore been used. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

Impact Descriptors

A3.8 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A3.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

⁶ The IAQM is the professional body for air quality practitioners in the UK.

Table A3.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants ^a

Long-Term Average Concentration At Receptor In Assessment Year ^b	Change in concentration relative to AQAL ^c				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

^a Values are rounded to the nearest whole number.

^b This is the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration where there is an increase.

^c AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A3.9 The IAQM guidance (EPUK & IAQM, 2015) is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either significant or not significant. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as 'slight' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A3.10 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality

objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

- A3.11 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A4 Professional Experience

Dr Ben Marner, BSc (Hons) PhD CSci MEnvSc MIAQM

Dr Marner is a Technical Director with AQC, and has over fifteen years' experience in the field of air quality. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has been an expert witness at several public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has extensive experience of using detailed dispersion models, as well as contributing to the development of modelling best practices. Dr Marner has arranged and overseen air quality monitoring surveys, as well as contributing to Defra guidance on harmonising monitoring methods. He has been responsible for air quality review and assessments on behalf of numerous local authorities. He has also developed methods to predict nitrogen deposition fluxes on behalf of the Environment Agency, provided support and advice to the UK Government's air quality review and assessment helpdesk, Transport Scotland, Transport for London, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Kieran Laxen, MEng (Hons) AMEnvSc MIAQM

Mr Laxen is a Senior Consultant with AQC with over six years' experience in the field of air quality management and assessment. Previously having two years' experience in scientific research on internal combustion engines, he now works in the field of air quality. He is involved in a wide range of development projects, most of which have involved use of ADMS modelling methodologies for biomass boilers, CHP plant and roads, and is also competent in the assessment of construction dust. He has pioneered the use of OpenAir software within the Company, which is used to analyse air quality monitoring data, and is responsible for routine calibration of air quality monitoring stations, together with data ratification. He is a Member of the Institute of Air Quality Management.

Paul Outen, BSc (Hons)

Mr Outen is a Consultant with AQC, having joined in 2014. He holds a degree in Environmental Geoscience, having specialised in the study of landfill-related particulate matter for his final year thesis. Prior to joining AQC he worked as an Air Quality Consultant at Odournet UK Ltd for 6 years, undertaking a range of air quality and odour assessments across a number of different industries, as well as managing the sampling/technical department for the company. He now undertakes air quality assessments at AQC, utilising the ADMS dispersion models to assess the impacts of a variety of sources on concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5}.

Full CVs are available at www.aqconsultants.co.uk.

A5 Modelling Methodology

Background Concentrations

- A5.1 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2015b). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The maps include the influence of emissions from a range of different sources; one of which is road traffic. As noted in Paragraph 3.13, there is evidence that the current 'official' emissions factors published by Defra may over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2011 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2011. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.
- A5.2 In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2014, it is assumed that there was no reduction in the road traffic component of backgrounds between 2011⁷ and 2014. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2015b). For each grid square, the road traffic component has been held constant at 2011 levels, while 2014 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2015b) publishes to accompany the maps. The result is a set of 'adjusted 2014 background' concentrations.
- A5.3 As an additional step, the 'adjusted 2014 background' mapped nitrogen dioxide values have been plotted against national background measurements made as part of the AURN (Defra, 2015d) during 2014 (see Figure A5.1). Based on the 40 sites with more than 75% data capture for 2014, the maps show an almost 1:1 relationship, being just 0.2% different. Thus no further adjustment has been applied to the 'adjusted' 2014 background concentrations and 2016 background concentrations.

⁷ This approach assumes that there has been no reduction in emissions per vehicle, but that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. This discrepancy is unlikely to influence the overall conclusions of the assessment.

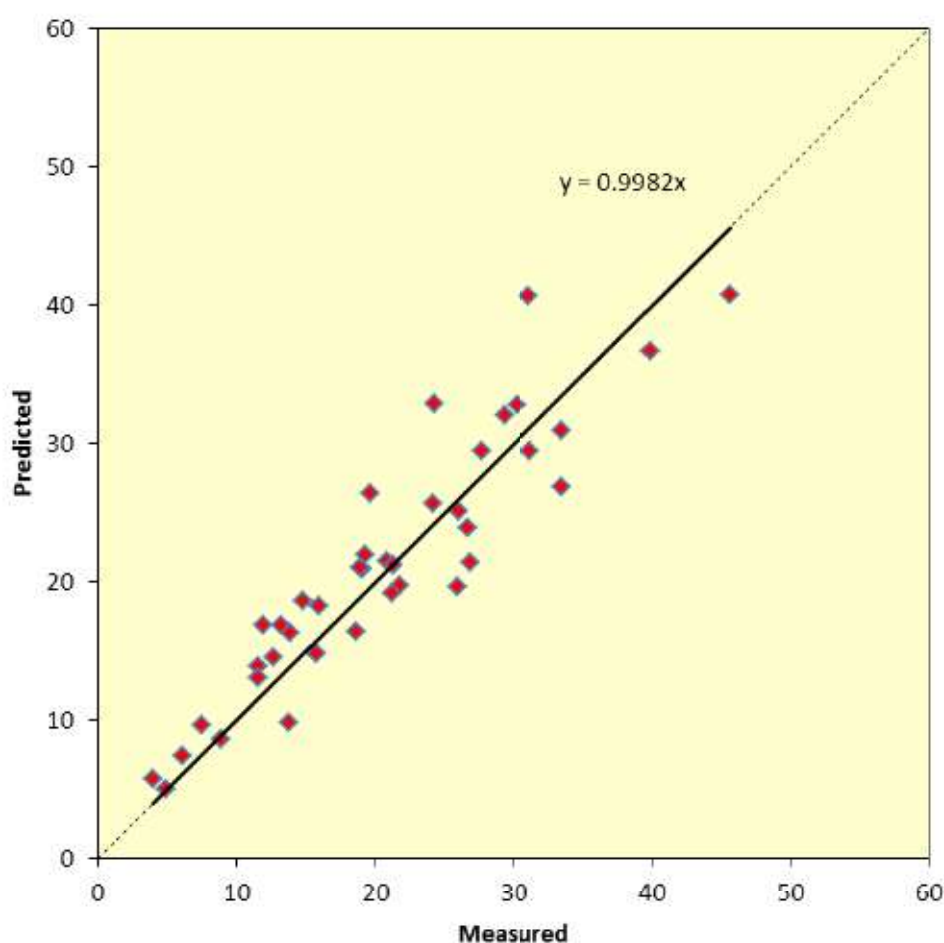


Figure A5.1: Predicted Mapped versus Measured NO₂ Concentrations at AURN Background Sites in 2014

- A5.4 Two separate sets of 2016 background nitrogen dioxide and nitrogen oxides concentrations have been used for the future-year assessment. The 2016 background 'without emissions reduction' has been calculated using the same approach as described for the 2014 data: the road traffic component of background nitrogen oxides has been held constant at 2011 values, while 2016 data are taken for the other components. Nitrogen dioxide has then been calculated using Defra's background nitrogen dioxide calculator. The 2016 background 'with emissions reduction' assumes that Defra's revised predicted reductions occur from 2014 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2016 to the unadjusted mapped value for 2014. This ratio has then been applied to the adjusted 2014 value (as derived in Paragraph A5.2).
- A5.5 For PM₁₀ and PM_{2.5}, there is no strong evidence that Defra's predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

Model Inputs

Road Traffic

- A5.6 Predictions have been carried out using the ADMS-Roads dispersion model (v3.4). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the Emission Factor Toolkit (Version 6.0.2) published by Defra (2015b). For nitrogen dioxide, future-year concentrations have been predicted once using year-specific emission factors from the EFT, and once using emission factors for 2014⁸, which is the year for which the model has been verified.
- A5.7 The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2014). The meteorological data has been taken from the monitoring station located at Northolt, which is considered suitable for this area.
- A5.8 For the purposes of modelling, it has been assumed that the front façades of a number of existing properties are within a street canyon formed by the buildings on White Hart Lane and High Road. This road has a number of canyon-like features, which reduce dispersion of traffic emissions, and can therefore lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. These roads are not full canyons however, as there are gaps between buildings allowing a reasonable level of near-road dispersion. As a precautionary measure, the canyon-like sections of these roads has been assumed to be canyons and ADMS-roads may therefore have over predicted concentrations at the façades of the properties in these areas.
- A5.9 AADT flows, diurnal flow profiles, speeds, and vehicle fleet composition data have been provided by Tim Spencer and Co who prepared the Transport Assessment. Traffic data have been provided for all the scenarios. Baseline traffic data have been derived from 24 hour counts at 20 locations within the local area in 2015. These traffic counts were taken on a non-event day and therefore do not include the contribution to the annual average daily flows of the event-day traffic. The one day traffic counts have been adjusted to represent annual average daily traffic (AADT) flows using DfT adjustment factors for typical urban areas, taking account of the time of year the counts were carried out.
- A5.10 An event-day cordon analysis has been carried out by Tim Spencer and Co. This analysis compared the number of trips that arrived/departed an area of within approximately 1 km of the development per year. This has been based on the number of trips per event multiplied by the frequency of events. This annual trip generation has been compared with the total number of trips predicted on the main local roads for non-event days within 1 km of development (39,154,158 trips) to calculate the ratio of event related traffic to non-event related traffic as an annual factor. Based

⁸ i.e. combining current-year emission factors with future-year traffic data.

on 30 events this factor is 1.066 assuming a trip rate per event of 8,550 ($30 \times 8,550 / 39,154,158$). This is assumed to be the existing situation given 30 events per year.

- A5.11 The uplift factor of 1.066 has been applied to the baseline 2015 traffic flows. The resultant baseline traffic data set represents AADT flows including the existing stadium related event-day traffic.
- A5.12 Tim Spencer and Co have identified that traffic flows on local roads have been fairly constant over recent years, and if anything reducing. Therefore as a worst-case this 2015 baseline traffic dataset has been taken to represent both 2014 and future year baseline traffic data.
- A5.13 The 2016 "without development" traffic datasets include the construction traffic generated by the THFC development assuming that concrete batching is undertaken at the main development site, and also imported from elsewhere. The 2016 "with development" datasets assume that the concrete batching within the construction compound at White Hart Lane is fully operational, and that no concrete batching is undertaken elsewhere. The construction traffic generation and flow distribution has been provided by Tim Spencer and Co. The traffic flows used in the assessment are provided in Table A5.1, and the modelled road links are shown in Figure A5.2.

Table A5.1: Summary of Traffic Data used in the Assessment (AADT)

Road Link	2014		2016 (Without Scheme)		2016 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
1	21,592	6.9	21,634	7.0	21,623	7.0
2	21,592	6.9	21,634	7.0	21,623	7.0
3	21,592	6.9	21,634	7.0	21,623	7.0
4	17,772	7.8	17,814	8.0	17,803	7.9
5	18,088	7.6	18,129	7.9	18,118	7.8
6	18,088	7.0	18,129	7.2	18,146	7.3
7	18,088	7.0	18,129	7.2	18,146	7.3
8	18,088	7.0	18,088	7.0	18,088	7.0
9	17,125	8.5	17,125	8.5	17,125	8.5
10	17,125	8.5	17,125	8.5	17,125	8.5
11	17,125	8.5	17,125	8.5	17,125	8.5
12	17,125	8.5	17,125	8.5	17,125	8.5
13	16,499	10.8	16,499	10.8	16,499	10.8
14	16,499	10.8	16,499	10.8	16,499	10.8

Road Link	2014		2016 (Without Scheme)		2016 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
15	16,499	10.8	16,499	10.8	16,499	10.8
16	11,673	6.2	11,673	6.2	11,673	6.2
17	11,673	6.2	11,673	6.2	11,673	6.2
18	14,092	2.8	14,092	2.8	14,092	2.8
19	14,092	2.8	14,092	2.8	14,092	2.8
20	1,970	2.4	1,970	2.4	1,970	2.4
21	1,970	2.4	1,970	2.4	1,970	2.4
22	12,318	4.1	12,318	4.1	12,345	4.4
23	12,318	4.1	12,318	4.1	12,345	4.4
24	12,318	4.1	12,318	4.1	12,318	4.1
25	14,056	4.7	14,056	4.7	14,056	4.7
26	14,056	4.7	14,056	4.7	14,056	4.7
27	18,088	7.6	18,129	7.9	18,118	7.8
28	12,318	4.1	12,318	4.1	12,345	4.4
29	18,088	7.0	18,129	7.2	18,146	7.3
30	6,785	7.3	6,785	7.3	6,785	7.3
31	6,785	7.3	6,785	7.3	6,785	7.3
32	1,274	1.6	1,274	1.6	1,274	1.6
33	1,274	1.6	1,274	1.6	1,274	1.6
34	1,274	1.6	1,274	1.6	1,274	1.6
35	1,274	1.6	1,274	1.6	1,274	1.6
36	7,156	5.0	7,156	5.0	7,156	5.0
37	7,156	5.0	7,156	5.0	7,156	5.0
38	7,156	5.0	7,156	5.0	7,156	5.0
39	7,156	5.0	7,156	5.0	7,156	5.0
40	21,592	6.9	21,634	7.0	21,623	7.0
41	14,056	4.7	14,056	4.7	14,056	4.7
42	672	3.9	672	3.9	672	3.9
43	672	3.9	672	3.9	672	3.9
44	672	3.9	672	3.9	672	3.9

Road Link	2014		2016 (Without Scheme)		2016 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
45	287	0.8	287	0.8	287	0.8
46	21,592	6.9	21,634	7.0	21,623	7.0
47	21,592	6.9	21,634	7.0	21,623	7.0
48	21,592	6.9	21,634	7.0	21,623	7.0
49	17,772	7.8	17,814	8.0	17,803	7.9
50	18,088	7.6	18,129	7.9	18,118	7.8

A5.14 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (DfT, 2011).

A5.15 Figure A5.2 shows the road network included within the model.

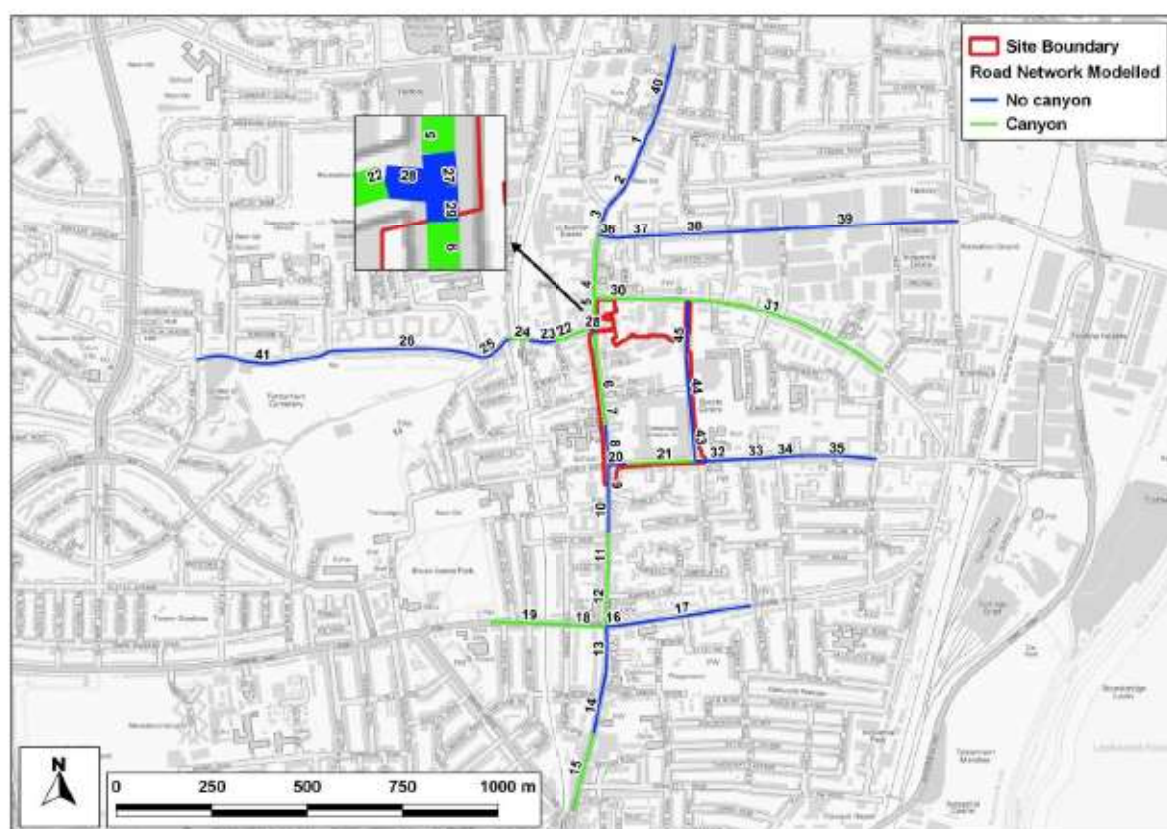


Figure A5.2: Modelled Road Network

Contains Ordnance Survey data © Crown copyright and database right 2015

Model Verification

- A5.16 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Background Concentrations

- A5.17 The background concentration of nitrogen dioxide for the verification site has been taken from the national maps of background concentrations available from the Defra LAQM Support website (Defra, 2015b). The background concentrations for the verification sites are presented in Table A5.2.

Table A5.2: Background Concentrations used in the Verification for 2014

Monitor	NO ₂	PM _{2.5}
HGY1	29.0	15.0

Nitrogen Dioxide

- A5.18 Most nitrogen dioxide (NO₂) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_x = NO + NO₂). The model has been run to predict the annual mean NO_x concentrations during 2014 at the HGY1 automatic monitoring site. Concentrations have been modelled at 3.0 m, the height of the monitor inlet.
- A5.19 The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x. Measured road-NO_x has been calculated from the measured NO_x concentration and the predicted background NO_x concentration.
- A5.20 An adjustment factor has been determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor has then been applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO₂ concentration within the NO_x to NO₂ calculator (Defra, 2015b).
- A5.21 The data used to calculate the adjustment factor are provided below:
- Measured NO₂ : 43.82 µg/m³
 - 'Measured' road-NO_x (total – background): 33.99 µg/m³
 - Modelled road-NO_x = 17.94 µg/m³

- Primary Road-NO_x adjustment factor: = **1.89⁹**
- Final Modelled Total NO₂ (using Defra NO_x:NO₂ calculator) = 44.5 µg/m³

A5.22 The factor implies that the unadjusted model is under-predicting the road-NO_x contribution. This is a common experience with this and most other models.

PM₁₀ and PM_{2.5}

A6.6.1 The model has been run to predict annual mean road-PM_{2.5} concentrations during 2014. A similar process to calculate the road-NO_x adjustment factor has been followed.

A6.6.2 The measured road-PM_{2.5} and modelled road-PM_{2.5} concentrations are compared to provide the factor for PM_{2.5}. The data used to calculate the adjustment factor are provided below:

- Measured PM_{2.5}: 16.40 µg/m³
- 'Measured' road-PM_{2.5} (measured – background at monitor): 16.40 – 14.99 = 1.41 µg/m³
- Modelled road-PM_{2.5} = 0.61 µg/m³
- Road-PM_{2.5} adjustment factor: 1.41/0.61 = **2.31**

Model Post-processing

Road Traffic

Nitrogen oxides and nitrogen dioxide

A5.23 The model predicts road-NO_x concentrations at each receptor location. These concentrations have then been adjusted using the primary adjustment factor, which, along with the background NO₂, has been processed through the NO_x to NO₂ calculator available on the Defra LAQM Support website (Defra, 2015b). The traffic mix within the calculator has been set to "All London traffic", which is considered suitable for the study area. The calculator predicts the component of NO₂ based on the adjusted road-NO_x and the background NO₂. This has then been adjusted by the secondary adjustment factor to provide the final predicted concentrations.

⁹ Based on un-rounded values

A6 Adjustment of Short-Term Data to Annual Mean

- A6.1 The Haringey Town Hall automatic monitor had large gaps in its data collection during 2014. No nitrogen dioxide data were collected between 27th May and 1st October, resulting in an annual data capture rate of 65.3%. PM₁₀ data capture was very low, at just 25.7% for the year. PM_{2.5} data had gaps between 17th February and 7th March and between 10th August and 27th September, resulting in a total annual data capture rate of 82.2%.
- A6.2 In accordance with the guidance set out in Box 3.2 of LAQM.TG(09), the nitrogen dioxide and PM_{2.5} data have been adjusted to an annual mean, based on the ratio of concentrations during the short-term monitoring periods to those over the 2014 calendar year at nearby background automatic monitoring sites. PM₁₀ data capture was so low that it would not be appropriate to annualise.
- A6.3 The annual mean nitrogen dioxide concentrations and the period means for each of the three monitoring sites from which adjustment factors have been calculated for nitrogen dioxide are presented in Table A6.1, along with the Overall Factor. The "short-term monitoring period" referred to covers the periods 1st January to 27th May and 1st October to 31st December.

Table A6.1: Data used to Adjust Short-term Nitrogen Dioxide Monitoring Data at Haringey Town Hall to Annual Mean

Period Mean Concentration (µg/m ³)	Camden Bloomsbury	Harrow Stanmore	Kensington & Chelsea North Kensington	Overall Factor
2014 Calendar Year	51.2	24.6	34.4	-
Short-Term Monitoring Period	54.0	28.3	37.3	-
Adjustment Factor	0.949	0.869	0.921	0.913

- A6.4 The annual mean PM_{2.5} concentrations and the period means for each of the two monitoring sites from which adjustment factors have been calculated for PM_{2.5} are presented in Table A6.2, along with the Overall Factor. The "short-term monitoring period" referred to covers the periods 1st January to 17th February, 7th March to 10th August and 27th September to 31st December.

Table A6.2: Data used to Adjust Short-term PM_{2.5} Monitoring Data at Haringey Town Hall to Annual Mean

Period Mean Concentration (µg/m ³)	Camden Bloomsbury	Hillingdon Harlington	Overall Factor
2014 Calendar Year	14.6	14.0	-
Short-Term Monitoring Period	14.3	13.6	-
Adjustment Factor	1.028	1.026	1.027

Archaeological Deskbased Assessment for the

NORTHUMBERLAND PARK DEVELOPMENT PROJECT

For Tottenham Hotspur Property Co Ltd

Johanna Zetterstrom-Sharp MA

L-P:ARCHÆOLOGY

Archaeological Deskbased Assessment for the

NORTHUMBERLAND PARK DEVELOPMENT PROJECT

Client: Tottenham Hotspur Property Co Ltd

Local Authority: Haringey Borough Council

NGR: 534003, 191256

Planning App:

Author(s): J Zetterstrom-Sharp

Doc Ref: LP0627L-DBA-v1.2

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Abstract

Land located directly to the north and south of Paxton Road, bound by the High Road, Worcester Avenue and Northumberland Road, is proposed for redevelopment. This report contains results of cartographic, archaeological, and documentary research into the site undertaken by L – P : Archaeology on behalf of Tottenham Hotspur Property Co Ltd.

The area to the north-west of the site lies within an Archaeological Priority Area. The site contains seven listed buildings and two archaeological findspots. These are limited to the boundary of the site along the High Road.

There is limited evidence for any significant Prehistoric or Roman activity in the immediate vicinity of the study site, although the line of the present High Road is suggested to be that of Roman Ermine Street.

The majority of the archaeological activity in Tottenham dates to the Medieval and Post Medieval periods. The village saw an increase in importance towards the end of the Medieval period when a number of inns were built to cater for passing trade. The Post Medieval period saw the construction of smaller high-end properties along the High Road, seven of which are listed.

It is likely that archaeological works will be required due to this Medieval and Post Medieval activity and as a result of the extensive ground works expected by the proposed development.

1. Introduction and Scope of Study

- 1.1. This archaeological desk based assessment has been researched and prepared by Johanna Zetterstrom-Sharp of L - P : Archaeology on behalf of Tottenham Hotspur Property Co Ltd.
- 1.2. The report considers land known as the Northumberland Development Project. The local authority is the London Borough of Haringey who take archaeological advice from the Greater London Archaeological Advisory Service.
- 1.3. The site is currently proposed for redevelopment involving the construction of a new stadium for Tottenham Hotspur Football Club and associated development.
- 1.4. The site occupies an area of approximately 8.19ha and is centered at National Grid Reference 534003,191256 (FIGURE 1). The site is bound to the north by Northumberland Park, to the east by Worcester Avenue, to the south by Park Lane and to the west by the Tottenham High Road (FIGURE 2).
- 1.5. The area to the north-west of the site is contained within an Archaeological Priority Area (APA) associated with a stretch of Medieval and Post Medieval listed buildings along the High Road, and an excavation of a Medieval farm house between 1998-1999. Seven listed buildings and two archaeological findspots are located within the proposed development area, fronting the High Road. There are no scheduled monuments in the vicinity.
- 1.6. This assessment is based on the results of documentary and cartographic research as well as published and unpublished literature.
- 1.7. This assessment also comprises an examination of the GLSMR (Great London Sites and Monuments Record), local excavations and watching briefs, topographic information and a map regression exercise.
- 1.8. The assessment seeks to address the following issues:
 - ◆ To assess the potential archaeology on this site
 - ◆ To assess the survival of potential archaeology

2. Planning Background

2.1. In November 1990 the Department of the Environment issued PPG 16, "Archaeology and Planning". This document provides guidance for planning authorities, property owners, developers and others on the preservation and investigation of archaeological remains.

2.2. In considering any planning application for development the local planning authority, the London Borough of Haringey, is bound by the policy frameworks provided by Planning Policy Guidance Notes 15 and 16 (PPG 15, PPG16), and the policies within the borough's Unitary Development Plan (adopted July 2006). On matters concerning archaeology and the historic environment the Haringey Borough Council take impartial advice from the Greater London Archaeological Advisory Service (GLAAS).

2.3. The relevant policy contained within the UDP is as follows:

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Planning permission will only be granted for development which would adversely affect areas of archaeological importance if the following criteria are met:

- a) applications are accompanied by an archaeological assessment and evaluation of the site, including the impact of the proposed development.
- b) development proposals will preserve in situ, protect and safeguard important archaeological remains and the settings and, where appropriate, provide for the permanent display and interpretation of the remains. The Council will ensure the proper investigation, recording of sites and publication of the results is conducted by a suitably qualified archaeological contractor, as an integral part of a development programme where a development incorporates archaeological remains or where it is considered that preservation in situ is not appropriate.

2.4. The north-west of the study site falls within an Archaeological Priority Area as designated by the London Borough of Haringey (FIGURE 3). While this does not confer any special legal protection to the site it does indicate that some form of further archaeological investigation is likely to be required by the local planning authority.

2.5. This report has been produced in order to assess the archaeological potential and the survival of archaeological features on site.

3. Geology and Topography

3.1.GEOLOGY

- 3.1.1. The British Geological Survey GeoIndex shows the site to be located on River Terrace Gravels and Alluvial deposits associated with the Lea Valley. This data is at relatively low resolution and it is inaccurate to state the geology only from this source.
- 3.1.2. Archaeological investigations to the north-west of the site in 2006 encountered alluvial deposits, including peat related to the ancient fluvial system of the River Lea (HAWKINS 2006, BAMFORTH & WILLIAMS 2006).

3.2.TOPOGRAPHY

- 3.2.1. The site is located approximately 1380m west of the River Lea and associated Lea Valley. The Moselle stream runs 368m west of the site, meeting the High Road to the north.
- 3.2.2. The site is broadly flat although it gradually falls over 1m over its entire length. The highest point on the site is at the intersection of Paxton Road – Worcester Avenue Junction.

4. Archaeological and Historical Background

4.1.TIMESCALES USED IN THIS REPORT:

PERIOD	FROM	TO
PREHISTORIC		
PALAEOLITHIC	450,000	12,000 BC
MESOLITHIC	12,000	4,000 BC
NEOLITHIC	4,000	1,800 BC
BRONZE AGE	1,800	600 BC
IRON AGE	600	43 AD
HISTORIC		
ROMAN	43	410 AD
EARLY MEDIEVAL	410	1066 AD
MEDIEVAL	1066	1485 AD
POST MEDIEVAL	1485	PRESENT

4.2.It is not the aim of this assessment to present a complete history of Tottenham from earliest times, nor is it the intention of this report to examine every archaeological site and listed building found in the local area. Rather, the aim of this assessment is to review the data available and to use this to construct a model of the potential archaeology of the specific study site.

4.3.A search of the Greater London Sites and Monuments Record (GLSMR) within a 500m radius of the study site reveals a number of listed buildings and sites of recent archaeological investigation dating almost exclusively to the Medieval and Post Medieval periods.

4.4.PREHISTORIC

4.4.1. The proposed development site lies in the Lower Lea Valley, an area of recognised Prehistoric activity (BAMFORTH 2007). There are however no GLSMR entries from the Palaeolithic, Mesolithic, Neolithic periods nor the Bronze and Iron Ages within the search area.

- 4.4.2. Evidence for occupation of the Lower Lea Valley in the Lower Palaeolithic has been found from a collection of sites in the Stoke Newington area, approximately 4.5km south of Tottenham (WYMER 1999: 63). A series of primary context palaeoliths were uncovered in colluvial deposits along side deposits of mammalian bones, shells and plant remains by Worthington G. Smith in 1874, during residential development in the area (WYMER 1999: 64).
- 4.4.3. Later Prehistoric sites in the wider area include a site excavated along Glover Drive, 1.2km to the north-east of the proposed development area, that recovered over 100 struck flints dating to the Mesolithic alongside red deer and roe deer bones inferring hunting in the area (STEPHENSON 2005). Evidence for *in situ* occupation includes a Neolithic/Early Bronze Age field system recorded by Pre-Construct Archaeology (PCA) between 1999 and 2000 along Plevna Road and Montague Road in Edmonton, approximately 2.3km north of the study site (BAMFORTH 2007).
- 4.4.4. The lack of Prehistoric evidence in the immediate area may be a result of extensive Post Medieval development and inadequate recording of archaeology during this period. It is unlikely to be representative of zero occupation during the Prehistoric period due the location of the site in the Lower Lea Valley. The potential for uncovering Prehistoric archaeological remains should however be considered low as the extent of development in the area is likely to have negatively impacted on any such archaeology.

4.5.ROMAN

- 4.5.1. The study site falls along the Tottenham High Road, the suspected route of the Roman Ermine Street connecting London with northern regional centers of Lincoln and York (FIGURE 4). The line of the road is said to have followed the present day A10, running through Dalston, Stoke Newington, Stamford Hill and Tottenham (MARGARY 1966: 195).
- 4.5.2. There is one GLSMR entry from the Roman period referring to a six metre wide gravel bank bound by small ditches, uncovered during the construction of a sewer trench in 1956 (MLO6620). It has been argued that this may constitute part of the Roman Ermine Street which is supported by the fact that

it lies along the High Road, 277m north of the study site (*ibid*).

4.5.3. The nearest known Roman Settlement following the probable line of Ermine Street is located in Enfield, approximately 4500m north of Tottenham (FINCH SMITH 1987: 177). A site at Lincoln Road towards the southern limits of present day Enfield dated the occupation of the settlement to between the late-first century, to the fourth century (*ibid*). It has been argued that this site was located at the southern periphery of Roman Enfield suggesting occupation would not have run south into Tottenham (GENTRY 1977: 111-115).

4.5.4. Due to a lack of Roman remains in the immediate vicinity and a pattern of Roman activity further to the north, the potential for site activity during this period can be considered low.

4.6.MEDIEVAL

4.6.1. The earliest recorded date of Tottenham is said to be from 894 AD when 'Danes invaded England, and Sailed up the River Lea...at this time from Tottenham to Hertford one continuous lake' (FISK 1913: 2).

4.6.2. An Anglo-Saxon settlement, otherwise unrecorded, is mentioned in the 1086 Domesday Survey where the area is referred to as Totta's *Ham* (COCKBURN *ET AL* 1969: 95). At the time of the survey the manor of Tottenham constituted of meadowland, ploughland and forest. It was valued at £25 15s. and 3 ounces of gold and assessed for 5 hides (approximately 120 acres per hide) (*ibid*).

4.6.3. The present location of the Tottenham Parish Church (654m west of the study site, FIGURE 5) is likely to occupy the same location as the first church of Tottenham, recorded in 1134 (BARKER *ET AL* 1976: 313). It is thought that the first manor-house of Tottenham, described in 1254 as belonging to the Bruce family, was located close to the church (*ibid*).

4.6.4. Tottenham manor was subdivided after 1254. The study site is likely to have been part of the manor granted to Richard Spigurnel in 1335, renamed the Mocking Manor in 1427 (BARKER *ET AL* 1976: 327, MLO20014) (FIGURE 6). The manor-house was located directly south of the study site, leading off from Park Lane, formerly Marsh Lane. The residential building and associated moat can

be seen in the 1619 Dorset Survey and the 1798 Wyburd Survey but has been demolished by the 1864 Orndance Survey. Mortar footing uncovered during an AOC Archaeology Group evaluation in 1997 is thought to be part of the foundations for the property (MLO71314).

- 4.6.5. It is likely that the majority of later Medieval activity took place along the Tottenham High Road which remained one of the main routes out of London to the north of England and provided a back bone to the developing village. The early phases of the village appear to have taken the form of small farmsteads. An archaeological investigation and watching brief, undertaken by AOC in 2000, revealed this progression with evidence for cultivation during the early Medieval period running through to the construction of a substantial farm house during the late-Post Medieval period (MLO98174, MLO73349, MELIKIAN 2005). This site is located 47m west of the proposed development site (FIGURE 4).
- 4.6.6. Tottenham High Cross, 1452m to the south of the study site, marks the center of the Medieval village of Tottenham and is said to be the spot where Edward I erected a column of wood in 1290 to commemorate the route of Eleanor of Castille's funeral cortège (ROBINSON 1840: 90). It has however later been suggested that the name refers to a wayside cross first mentioned in 1409 (BARKER *ET AL* 1976: 314).
- 4.6.7. Six Inns were recorded along the Tottenham High Road between 1455 and 1456 (BARKER *ET AL* 1976: 315). This confirms the expansion of the village of Tottenham and the High Road as an important route out of London by the 15th century.
- 4.6.8. Remains of three of these inns are present in the GLSMR for the area (FIGURE 4). The Lamb, said to be a 'considerable inn' with an attached farmstead (ROBINSON 1840: 61), was located within the boundary of the study site to the north-west (MLO10681, MLO27234). A Medieval stable, coach-house and house, collectively called 'The Horns' in 1620, was present opposite 'The Lamb' across the High Road (*ibid*, MLO4896). The property was demolished in 1824. The third inn is 'The Ale Bewhouse' thought to originate from the 14th century and

located at the periphery of the parish, 230m north of the study site (ROBINSON 1840: 63, MLO225).

- 4.6.9. It is evident that the study site is located on top of part of the Medieval village of Tottenham, and that Medieval structures were present within the boundaries of the site. The potential for archaeological remains dating to this period is considered to be high.

4.7. POST MEDIEVAL

- 4.7.1. The area of Tottenham has been steadily developed throughout the Post Medieval period with initial emphasis on the eastern side of the High Road in the 16th, 17th and 18th centuries spreading to the west by the 19th and 20th centuries.
- 4.7.2. The 1619 Dorset Survey is our first indication of Post Medieval development within the confines of the study site (FIGURE 6). A building was present in the north-eastern corner of the site named Ridley House, property of William Gore (BARKER *ET AL* 1976: 327). This is the same structure formerly called the Black House which is said to have been an inn frequented by Henry VIII. Indeed one of the rooms bore the inscription 'In this chamber King Henry VIII hath often lyen' (COUCHMAN 1910: 17). Four listed buildings constructed in 1840 - constituting the Northumberland Row- presently occupy the Black House site (MLO81955, MLO84364, MLO84421, MLO81954, FIGURE 5). It is said that these structures have incorporated building materials from the Tudor mansion (ROBINSON 1840: 97).
- 4.7.3. The remaining listed buildings standing on the proposed development site are a pair of grade II* 18th century terraced houses to the north (MLO84422) visible on the 1798 Wyburd Survey map (FIGURE??), and to the south an early 19th century Grade II property (MLO84009) and Warmington House (MLO84420), constructed between 1800 and 1832. These first visible in the 1864 Ordnance Survey map.
- 4.7.4. A notable trend in early Post Medieval Tottenham is the construction of a number of large properties. This is likely to be as a result of the increasing trend in leasing grand residences to wealthy Londoners as country retreats

(BARKER *ET AL* 1976: 327). Most notable is the redevelopment of the Bruce manor-house by 1619 into The Lordship House, later to be renamed Bruce Castle (630m south-west of the study site) (*ibid*).

- 4.7.5. Slightly less imposing was Crooks farm-house, visible in the 1619 Dorset Survey Map and uncovered during a 1998 to 1999 AOC excavation 43 meters west of the study site (MLO98174, MLO73349. The structure has been demolished by the time of the 1798 Wyburd Survey and a Villa constructed in its place, facing White Hart Lane (MLO84251).
- 4.7.6. Development trends appear to have changed during the 18th century. There is a marked transition along the eastern side of the High Road from larger farm-houses with estates, to smaller high-end housing with individual gardens. This process is apparent along the western edge of the proposed development site, with smaller plots of likely woodland occupying the eastern limits (FIGURE 7).
- 4.7.7. The 1798 Wyburd Survey shows what is presumed to be part of the Tottenham Nursery occupying some 60 acres and owned by the Coleman family (BARKER *ET AL* 1976: 336). Though this property does not occupy the study site at in 1798, it will later expand into the south-eastern corner.
- 4.7.8. Many of the 1798 structures are still present in the 1864 Ordnance Survey and the land to the west is still predominantly woodland with occasional plots of possible cultivated land (FIGURE 8). A line of terraced housing has however been constructed along the western corner of the Marsh Lane and the High Road, reflecting similar housing styles cropping up to the west of the High Road, opposite the study site. What is presumed to be a landscaped garden associated with the Tottenham Nursery has been constructed to the east of this housing.
- 4.7.9. Northumberland Park road, creating the northern limits of the study site, has been constructed by the 1864 Ordnance Survey. New residential housing associated with the new road occupies the north-eastern corner of the proposed development site.
- 4.7.10. The 1894 Ordnance Survey shows little change along the High Road and Northumberland Park Road from the previous. A number of structures

presumed to be associated with the Tottenham Nursery have however been built to the south; access to this development is from the newly constructed Paxton Road (FIGURE 9).

- 4.7.11. The above structures have been demolished as a result of the construction of the first phase of the Tottenham Hotspur football stadium in 1899, shown on the 1915 Ordnance Survey (FIGURE 10). The sunken football pitch is surrounded by an embankment likely to be fitted with seating. A substantial structure has been built to the western end of the grounds, presumably to house activities associated with the management and use of the stadium.
- 4.7.12. The 1915 Ordnance Survey shows that Paxton Road has taken a right-angled turn to the south as it reaches the limits of the stadium, meeting Park Lane – formerly Marsh Lane. This new stretch is lined with newly constructed terraced housing. The area to the north of Paxton Road remains largely unchanged apart from a stretch of terraced housing lining its northern edge.
- 4.7.13. A new football ground has been constructed by the 1935 Ordnance Survey map (FIGURE 11). This process has resulted in the demolishing of the terraced housing lining the stretch of Paxton Road aligned north-south. The area to the north of Paxton Road has been developed considerably as a likely industrial estate, though the 18th and 19th century housing lining the High Road has remained untouched. Worcester Avenue has appeared in the western limits of the proposed development leading to allotment gardens to the south. New terraced housing lines either side of the new road, and it still standing today.
- 4.7.14. Facilities associated with the Tottenham Hotspur Football Ground have expanded westwards by the 1998 Ordnance Survey (FIGURE 1), demolishing the row of terraced housing along Park Lane and 19th century buildings on the corner of Park Lane and the High Road. The line of terraced housing lining the northern side of Paxton Road has also been demolished to make way for offices.

5. Site Conditions and the Proposed Redevelopment

5.1.SITE CONDITIONS

- 5.1.1. The majority of standing structures remain on the proposed development site at the time of this report. These include a 36,240 seater football stadium, seven Post Medieval listed buildings, an industrial estate including offices and a row of terraced housing along Worcester Avenue. Buildings in the south-eastern corner of the industrial estate have been demolished, and the area has been levelled.
- 5.1.2. The area in the north-western corner of the site is included in an Archaeological Priority Zone, designated by Haringey Borough Council.
- 5.1.3. The majority of the proposed development site has undergone several phases of Post Medieval and modern redevelopment, though the western edge running along the High Road has remained largely untouched since the construction of a row of properties in the 18th and 19th century. These were not basemented so archaeological deposits may well still survive beneath them.
- 5.1.4. It is likely that the construction of the football stadium had a significant impact on any surviving archaeology due to the deep foundations required for a structure of this size and function.
- 5.1.5. Development of the area to the east of the High Road properties, in the industrial estate, is not likely to have had a similar impact. The majority appear to be temporary structures used to house construction materials and these are not basemented.



Plate 1 - Stadium, view from Park Lane facing west.



Plate 2 - Stadium, view from the High Road facing east.



Plate 3 - Listed Building MLO84420, High Road facing east.



Plate 4 - Listed Building MLO10681, High Road facing east.



Plate 5 - Paxton Road, facing east.



Plate 6 - Demolished area, Paxton Road facing north-east.



Plate 7 - Early 20th century residential development, Worcester Avenue facing north-west.



Plate 8 - Offices by the industrial estate, along Worcester Avenue facing west.



Plate 9 - Housing along Northumberland Park, facing south-west.

5.2.PROPOSED REDEVELOPMENT

- 5.2.1. The proposed development consists of a new stadium with a capacity of 58,247, located centrally on the site fronting onto the High Road, along with a foodstore to the north fronting onto Northumberland Park. A residential mixed use development including a hotel, new offices, shop and museum will be located to the south of the stadium.
- 5.2.2. The construction of the stadium will involve remediation and groundworks to set the ground level at 12.00m AOD. The construction programme will also include extensive piling and groundworks for the construction of both the stadium and the surrounding development.
- 5.2.3. These groundworks will have a significant effect on any surviving archaeology currently present on site. The extent of impacts will vary in severity across the site, however due to the nature of the development the whole site will be subject to ground disturbance by the construction process. It is expected that archaeological works will be required to clarify presence / absence of any archaeological remains prior to or during the commencement of building works.

6. Summary and Conclusions

- 6.1. The current site of the Tottenham Hotspur stadium, and the area to the north between Paxton Road and Northumberland Park, is proposed for redevelopment.
- 6.2. The proposed redevelopment involves the construction of a new football stadium, and the redevelopment of the area surrounding the stadium, including the construction of a foodstore and a mixed use residential area. The works are expected to involve extensive ground works.
- 6.3. Examination of the available data indicates that nine Post Medieval listed buildings presently occupy the site. These range from grade II and II*. The north-western corner of the development lies within an Archaeological Priority Zone. There are no scheduled monuments on the site, or in the immediate vicinity.
- 6.4. There are no known Prehistoric sites on, or surrounding, the proposed development site. The location of the site on the Lower Lea Valley does however suggest that this may not be result of zero activity but extensive Post Medieval and modern development and poor recording. The survival of such archaeology is however likely to be poor due to the ground works associated with this development.
- 6.5. The western edge of the site runs along the Tottenham High Road, said to follow the same route as Roman Ermine Street. There is however only one known Roman site in the surrounding area and Roman archaeology in nearby Enfield suggests that Tottenham lay to the south of any significant Roman activity.
- 6.6. Evidence from the Medieval period suggests that Tottenham has early Medieval origins, though the village of Tottenham appears to gain importance in the late-Medieval period. Likely Medieval archaeology on site include the foundations of 'The Lamb', a Medieval inn with an associated farmstead demolished by the early Post Medieval period. It is likely that further archaeology will be encountered along the stretch of the High Road though this may have been disturbed during Post Medieval development.
- 6.7. The majority of the redevelopment of the proposed study site occurred during the Post Medieval period. This involved the construction of an inn called the Black House, frequented by Henry VIII, later to be partly demolished and incorporated

into the still standing Northumberland Row. Further development occurred along the High Road during the 18th and 19th centuries – this phase encompasses the nine listed buildings presently on site.

- 6.8. The building of the present Tottenham Hotspur football stadium in 1899 gave way to further development of the area including the construction of Paxton Road and Worcester Avenue, and terraced housing lining these new roads. Building associated with the stadium spread outwards during the 20th century, demolishing many of the new residential properties. The redevelopment of the stadium in the early 20th century is likely to have had an impact on any surviving archaeology beneath it.
- 6.9. The area to the north of the stadium was first developed in the early 20th century and has since been used as an industrial estate with associated offices.
- 6.10. The proposed development is likely to have a significant impact on the survival of the Medieval and Post Medieval archaeology of the area, this is particularly the case if it will involve the demolishing of properties lining the High Road. It is likely that archaeological works will be required prior to and/or during development.

FIGURES

FIGURE I // Site Area - General



— Site Area

0

2,100 m



PROJECT // 0627L- Paxton Road, Tottenham

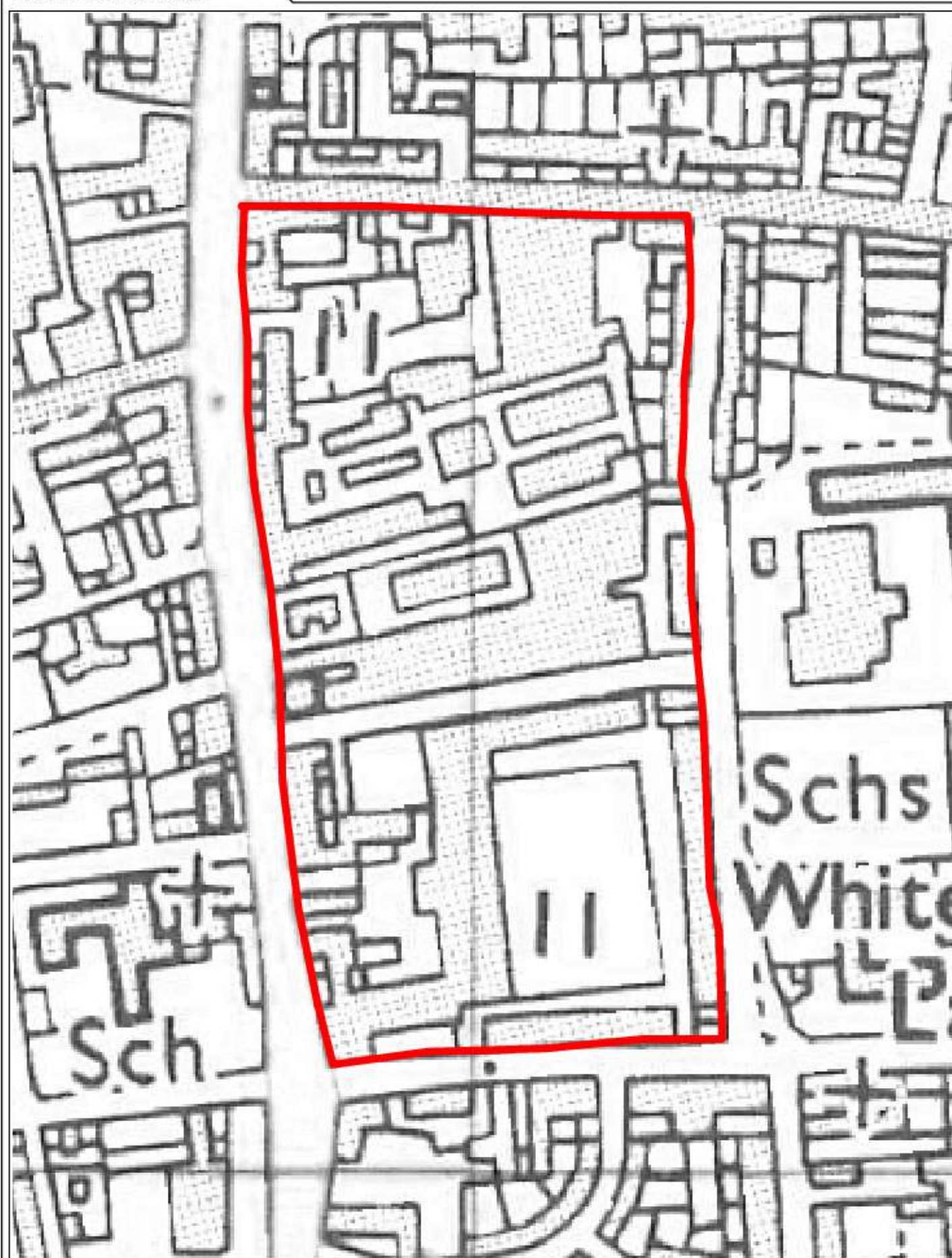
DESCRIPTION // Site Location - General

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FIGURE 2 // Site Area - Detailed



 Site Area

0 150 m



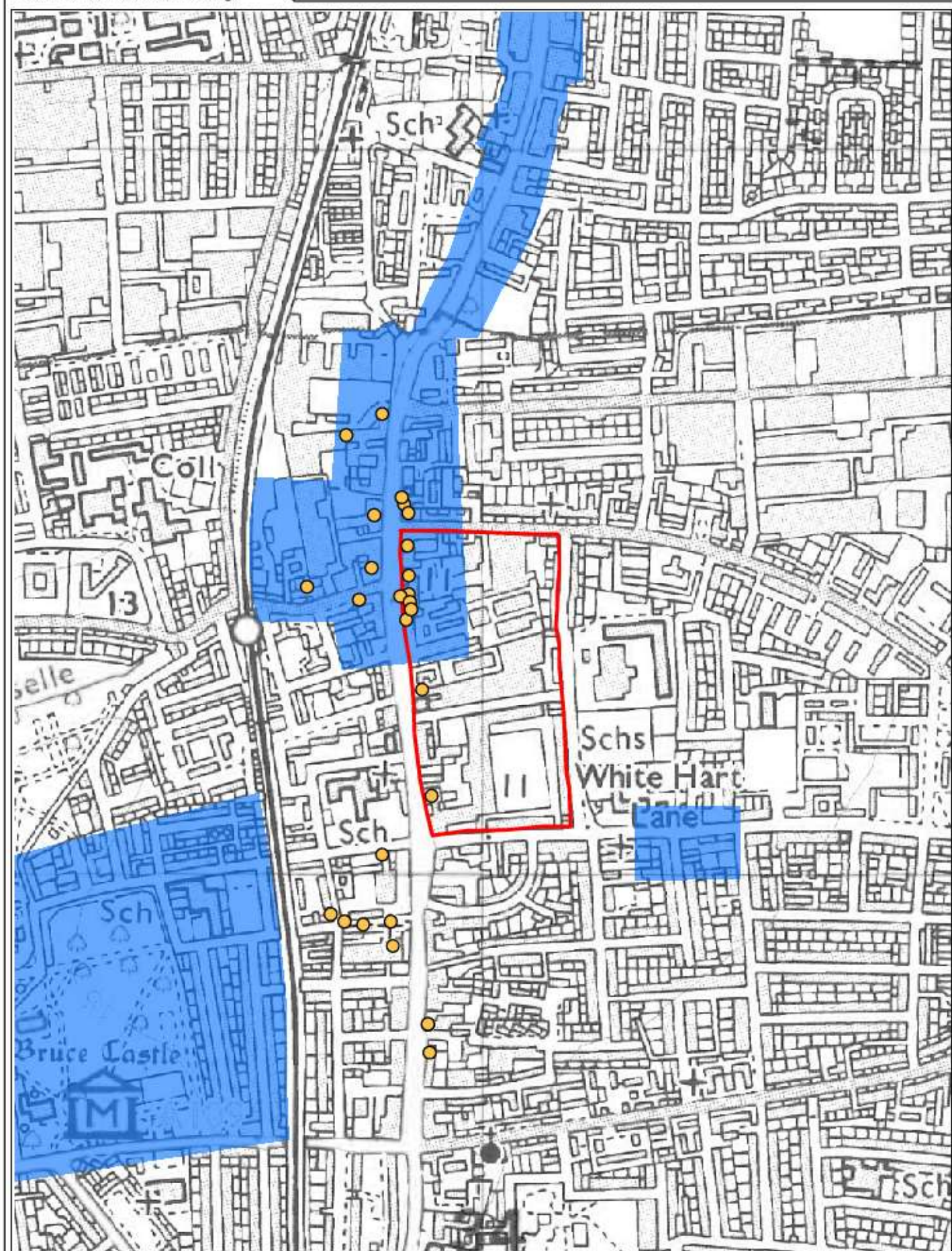
PROJECT // 0627L- Paxton Road, Tottenham

DESCRIPTION // Site Location - Detailed

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FIGURE 3// APAs and Listed Buildings



— Site Area ● Listed Buildings
 APA

0 500 m

PROJECT // 0627L- Paxton Road, Tottenham

DESCRIPTION // APAs and Listed Buildings

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FIGURE 4// Roman and Medieval



- Site Area
- Roman Road
- Roman
- ▲ Medieval

0 350 m



PROJECT // 0627L- Paxton Road, Tottenham

DESCRIPTION // Roman and Medieval

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FIGURE 5// Post Medieval



- Archaeology
- Site Area
- ▲ Listed Building

PROJECT // 0627L- Paxton Road, Tottenham

DESCRIPTION // Post Medieval

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0 400 m

THE WILDE

THE PARSONAGE GROUNDS

1619

Scale of Paces

Mockings Manor

Lordship House

Parish Church

PROJECT // 0627L- Paxton Road

DESCRIPTION // 1798 Wyburd Survey Map

DOC REF: LP0627L-DBA-v1.2

L-P:ARCHÆOLOGY

FIGURE 7 // 1798 Wyburd Survey Map



Site Area

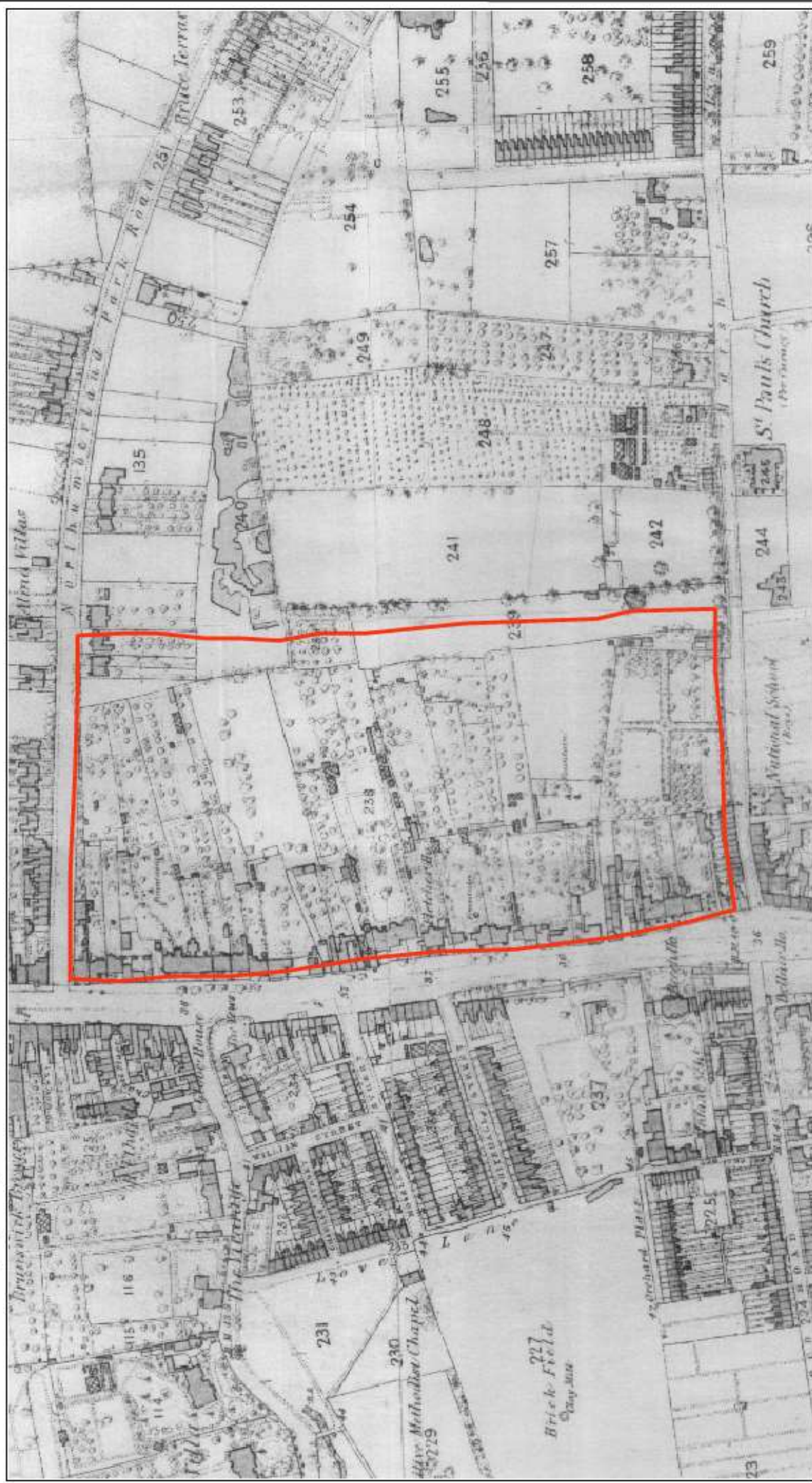
PROJECT // 0627L- Paxton Road

DESCRIPTION // 1798 Wyburd Survey Map

DOC REF: LP0627L-DBA-v1.2

L-P: ARCHAEOLOGY

FIGURE 8 // 1864 Ordnance Survey Map



Site Area

PROJECT // 0627L- Paxton Road
DESCRIPTION // 1864 Ordnance Survey Map

0 450 m

DOC REF: LP0627L-DBA-v1.2

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FIGURE 9 // 1894 Ordnance Survey Map



Site Area

PROJECT // 0627L- Paxton Road

DESCRIPTION // 1894 Ordnance Survey Map

0

450 m

DOC REF: LP0627L-DBA-v1.2

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FIGURE 10 // 1915 Ordnance Survey Map



Site Area

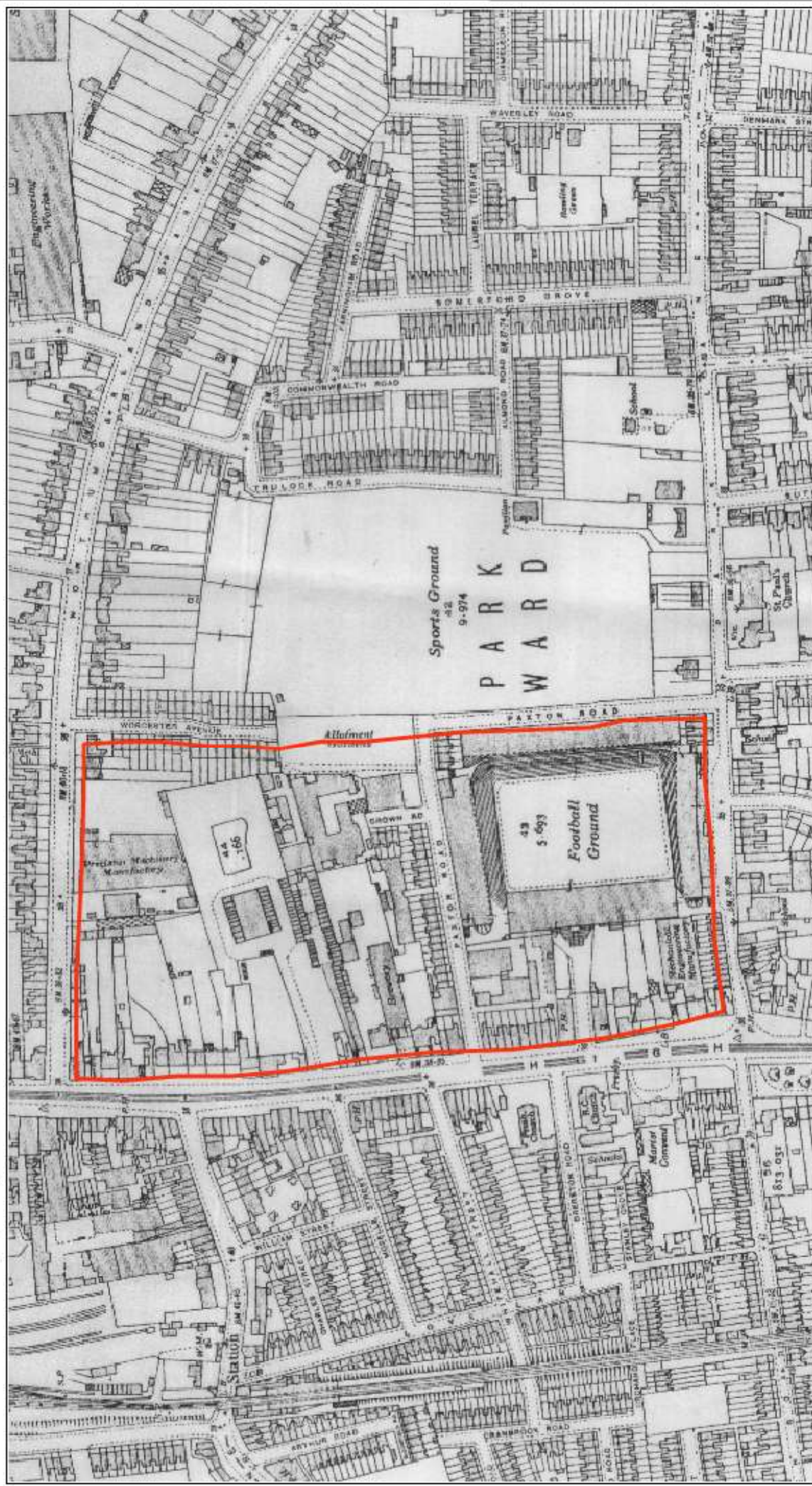
PROJECT // 0627L- Paxton Road
DESCRIPTION // 1915 Ordnance Survey Map

0 450 m

DOC REF: LP0627L-DBA-v1.2

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FIGURE 11 // 1935 Ordnance Survey Map



— Site Area

PROJECT // 0627L- Paxton Road
DESCRIPTION // 1935 Ordnance Survey Map



0 450 m

DOC REF: LP0627L-DBA-v1.2

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APPENDIX I

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Archaeological Evaluation Report

NORTHUMBERLAND PARK DEVELOPMENT

For Tottenham Hotspur FC

Cornelius Barton BA AIfA

L-P:ARCHÆOLOGY

Archaeological Evaluation Report

NORTHUMBERLAND PARK DEVELOPMENT

Client:	Tottenham Hotspur FC
Local Authority:	London Borough of Haringey
NGR:	516925, 201770
Planning App:	HGY-2010-1000 and HGY-2011-2350
Author(s):	C. Barton
Doc Ref:	LP0627L-AER-v1.1
Site Code:	NLN10
Date:	May 12

L-P:ARCHÆOLOGY

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Abstract

An archaeological evaluation was carried out at land at Northumberland Road, Haringey, London N17 0BP. The evaluation was implemented because of the potential for archaeological remains on the site. The work was carried out by L - P : Archaeology. This report has been prepared by Cornelius Barton of L - P : Archaeology on behalf of Tottenham Hotspur Football Club.

No archaeological remains are known to exist on the site or in its immediate surroundings. The area was not significantly developed until the Post Medieval period.

The objectives of the evaluation were to establish the presence or absence of archaeological remains, and to inform a mitigation strategy for any remains found.

No archaeological remains were found during the evaluation. The only remains predating the previous development were of the chemical works which stood on the site of the former visitors car park.

No further archaeological works are required on the area covered by this report.

1. Introduction

- 1.1. This evaluation report has been prepared by Cornelius Barton of L - P : Archaeology on behalf of Tottenham Hotspur FC.
- 1.2. The fieldwork was carried out by Michael Bamforth, Cornelius Barton and Anies Hassan of L – P : Archaeology in June and July of 2010.
- 1.3. The site is located at Northumberland Park, Tottenham within the London Borough of Haringey (FIGURE 1). The NGR is 516925, 201770.
- 1.4. The site code allocated by LAARC is NLN10.
- 1.5. The work was carried out in accordance with the Specification for Archaeological Evaluation (SAE) prepared by Matt Williams of L – P : Archeology.

2. Site Background

2.1.PLANNING

- 2.1.1. Two applications have been made with regard to the site. These are HGY-2010-1000 and HGY-2011-2350. The site area covered by this report was originally intended to be part of a wider development, but due to changed circumstances the development has now been divided.
- 2.1.2. The Local Planning Authority is the London Borough of Haringey (LBH). On matters concerning archaeology, LBH take impartial advice from Kim Stabler of English Heritage Greater London Archaeological Advisory Service (GLAAS).
- 2.1.3. The site does not contain any scheduled monuments or listed buildings. The north western corner of the site lies adjacent an archaeological priority zone as defined within the Unitary Development Plan. Within the area bordering on the site are five Grade II listed and two Grade II* listed buildings.
- 2.1.4. When considering an application, LBH is bound by local policy CSV:8 regarding archaeology and planning. As such, the following condition was attached to the development:

No development shall take place until the applicant has secured the implementation of a programme of archaeological work, in accordance with a written scheme of investigation has been submitted by the applicant and approved by the Local Planning Authority.

- 2.1.5. Tottenham Hotspur FC and LBH have agreed the methodology for these works in a Specification for Archaeological Evaluation (SAE). The SAE was compiled by Matt Williams for L – P : Archaeology (WILLIAMS 2009).

2.2.GEOLOGY

- 2.2.1. The British Geological Survey GeoIndex shows the site to be located on River Terrace Gravels and Alluvial deposits associated with the Lea Valley. ([HTTP://WWW.BGS.AC.UK/GEOINDEX](http://www.bgs.ac.uk/geoindex)).
- 2.2.2. The results of the evaluation confirm this in areas where natural deposits were encountered.

2.3.TOPOGRAPHY

- 2.3.1. The site is located approximately 1.4km west of the River Lea and associated Lea Valley. The site is broadly flat at 12.50mOD.
- 2.3.2. The site is bounded to the west by Tottenham High Road (A1010) to the north by Northumberland Park, to the east by Worcester Road and to the south by the north wall of the former visitors car park (FIGURE 2).
- 2.3.3. The site was previously in use as a trading estate.

2.4.SITE CONDITIONS

- 2.4.1. The site has seen extensive development during the 20th century, mainly associated with the Wingate trading estate. The industrial buildings on the site have now been demolished. Buildings fronting the High Road and Worcester Avenue have not been demolished.

2.5.ARCHAEOLOGY AND HISTORY

- 2.5.1. A full desk-based assessment of the site was previously undertaken by L – P : Archaeology (ZETTERSTROM-SHARP 2009). A summary of the results follows.

2.6.PREHISTORIC

- 2.6.1. The development site lies in the Lower Lea Valley, an area of recognised Prehistoric activity (BAMFORTH 2007). There are however no GLSMR entries from the Palaeolithic, Mesolithic, Neolithic periods nor the Bronze and Iron Ages within the search area.
- 2.6.2. Evidence for occupation of the Lower Lea Valley in the Lower Palaeolithic has been found from a collection of sites in the Stoke Newington area, approximately 4.5km south of Tottenham (WYMER 1999: 63). A series of primary context palaeoliths were uncovered in colluvial deposits along side deposits of mammalian bones, shells and plant remains by Worthington G. Smith in 1874, during residential development in the area (WYMER 1999: 64).

2.7.ROMAN

- 2.7.1. The study site falls along the Tottenham High Road, the suspected route of the

Roman Ermine Street connecting London with northern regional centres of Lincoln and York. The line of the road is said to have followed the present day A10, running through Dalston, Stoke Newington, Stamford Hill and Tottenham (MARGARY 1966: 195).

2.7.2. There is one GLSMR entry from the Roman period referring to a six metre wide gravel bank bound by small ditches, uncovered during the construction of a sewer trench in 1956 (MLO6620). It has been argued that this may constitute part of the Roman Ermine Street which is supported by the fact that it lies along the High Road, 277m north of the study site (*ibid*).

2.7.3. The nearest known Roman Settlement following the probable line of Ermine Street is located in Enfield, approximately 4500m north of Tottenham (FINCH SMITH 1987: 177). A site at Lincoln Road towards the southern limits of present day Enfield dated the occupation of the settlement to between the late-first century, to the fourth century (*ibid*). It has been argued that this site was located at the southern periphery of Roman Enfield suggesting occupation would not have run south into Tottenham (GENTRY 1977: 111-115).

2.8.MEDIEVAL

2.8.1. The earliest recorded date of Tottenham is said to be from 894 AD when 'Danes invaded England, and Sailed up the River Lea...at this time from Tottenham to Hertford one continuous lake' (FISK 1913: 2).

2.8.2. It is likely that the majority of later Medieval activity took place along the Tottenham High Road which remained one of the main routes out of London to the north of England and provided a back bone to the developing village. The early phases of the village appear to have taken the form of small farmsteads. An archaeological investigation and watching brief, undertaken by AOC in 2000, revealed this progression with evidence for cultivation during the early Medieval period running through to the construction of a substantial farm house during the late Post Medieval period (MLO98174, MLO73349). This site is located 47m west of the proposed development site.

2.9.POST-MEDIEVAL

- 2.9.1. The area of Tottenham has been steadily developed throughout the Post Medieval period with initial emphasis on the eastern side of the High Road in the 16th, 17th and 18th centuries spreading to the west by the 19th and 20th centuries.
- 2.9.2. The 1619 Dorset Survey is our first indication of Post Medieval development within the confines of the study site. A building was present in the north-eastern corner of the site named Ridley House, property of William Gore (BARKER *ET AL* 1976: 327). This is the same structure formerly called the Black House which is said to have been an inn frequented by Henry VIII. Indeed one of the rooms bore the inscription 'In this chamber King Henry VIII hath often lyen' (ZETTERSTROM-SHARP 2009). Four listed buildings constructed in 1840 - constituting the Northumberland Row- presently occupy the Black House site (MLO81955, MLO84364, MLO84421, MLO81954). It is said that these structures have incorporated building materials from the Tudor mansion (ROBINSON 1840: 97).
- 2.9.3. The remaining listed buildings standing on the proposed development site are a pair of Grade II* 18th century terraced houses to the north (MLO84422) visible on the 1798 Wyburd Survey map, and to the south an early 19th century Grade II property (MLO84009) and Warmington House (MLO84420), constructed between 1800 and 1832. These are first visible in the 1864 Ordnance Survey map.

3. Aims

3.1.1. The general aims of the archaeological evaluation were to assess the character, date, type, state of preservation, and extent of any archaeological remains on site.

3.1.2. The specific aims of the archaeological evaluation, as defined in the SWB were:

- ◆ To determine the presence or absence of archaeological deposits or remains
- ◆ To assess the character, date, location and preservation of any archaeological remains on the site
- ◆ To assess the nature and extent of any previous damage to archaeological remains on the site
- ◆ To assess the potential impact of the development proposals on surviving archaeological remains

3.1.3. The objective of this report is to provide enough information for a suitable mitigation strategy to be devised.

4. Methodology

4.1. For a full description of the archaeological methodology please refer to section 4 of the SAE (WILLIAMS 2010).

4.2. Seven trenches were dug in total (FIGURE 2). The trenches were dug as part of a larger evaluation of the entire development area, including the car park to the south. The original specification placed some of the trenches described in this report in slightly different locations, but allowed for some movement of trenches to avoid buried services. Some trenches were therefore positioned slightly differently to the layout in the SAE (WILLIAMS 2009) but covered a similar percentage of the ground surface.

5. Results

- 5.1.1. For the purposes of this report deposits are referred to by Group Numbers in (Parentheses). Context numbers assigned to each trench can be found in Appendix 2. Heights given are against Ordinance Datum (mOD) unless otherwise noted.
- 5.1.2. No deposits or features of archaeological significance were found in the evaluation. The stratigraphic sequence in all trenches was broadly similar, (see FIGURE 3) consisting of a layer of mixed building rubble and hardcore (1001) below the tarmac hard standing. This deposit was between 0.25 and 0.40m thick.



Plate 1 - Trench 5 from east, 2m scale.

- 5.1.3. Below this was a mixed of dark grey-brown silty clay with builders sand, brick fragments and assorted building debris (1002). This appeared to be a make-up deposit of 20th century origin, presumably laid down as a levelling deposit during the construction of the trading estate. This deposit was between 0.40m and 0.65m thick.
- 5.1.4. In trenches 6 and 7 a further deposit of make-up material was present below (1002). This was a very dark grey-brown silty clay with sand, glass and crushed brick inclusions of 20th century origin (1003). This material was noted but not retained.
- 5.1.5. Below (1002) and (1003) was the natural drift geology (1004), a deposit of clean yellow-brown silty clay with patches of coarse red-brown gravel (see Plate 1). Trenches 3, 4 and 6 contained modern service trenches containing gas and water pipes or electrical cables, clearly of 20th century origin. There were no archaeological features observed in any of the trenches.
- 5.1.6. The interface between the make-up deposits and natural drift geology was clear, and the natural deposits were uniform across the site and it is highly unlikely that archaeological features were present and not detected. Other than the brick and glass fragments in (1002) no artefactual material was recovered.

6. Summary and Conclusions

- 6.1. A site at Northumberland Park is proposed for redevelopment. The proposed redevelopment is for mixed retail and residential use with associated services.
- 6.2. Examination of the available data indicates that the site does not contain any scheduled monuments or listed buildings.
- 6.3. The results of the evaluation were negative. No archaeological deposits or artefacts were found during the works.
- 6.4. The disruption of the site caused by construction of the trading estate was considerable, but there is no evidence for the presence of archaeologically significant remains.
- 6.5. It is unlikely that further archaeological works will be required on the site in advance of redevelopment.

7. Archive

7.1. The paper archive consists of:

- ◆ 1 x Drawing Register
- ◆ 9 x Drawing Film
- ◆ 4 x Photographic Register
- ◆ 72 x Black and white photographs and negatives
- ◆ 1x Context Register
- ◆ 7 x Trench sheets
- ◆ 1 CD of digital images

7.2. There is no finds archive.

7.3. The archive is to be deposited at the Museum of London.

SOURCES CONSULTED

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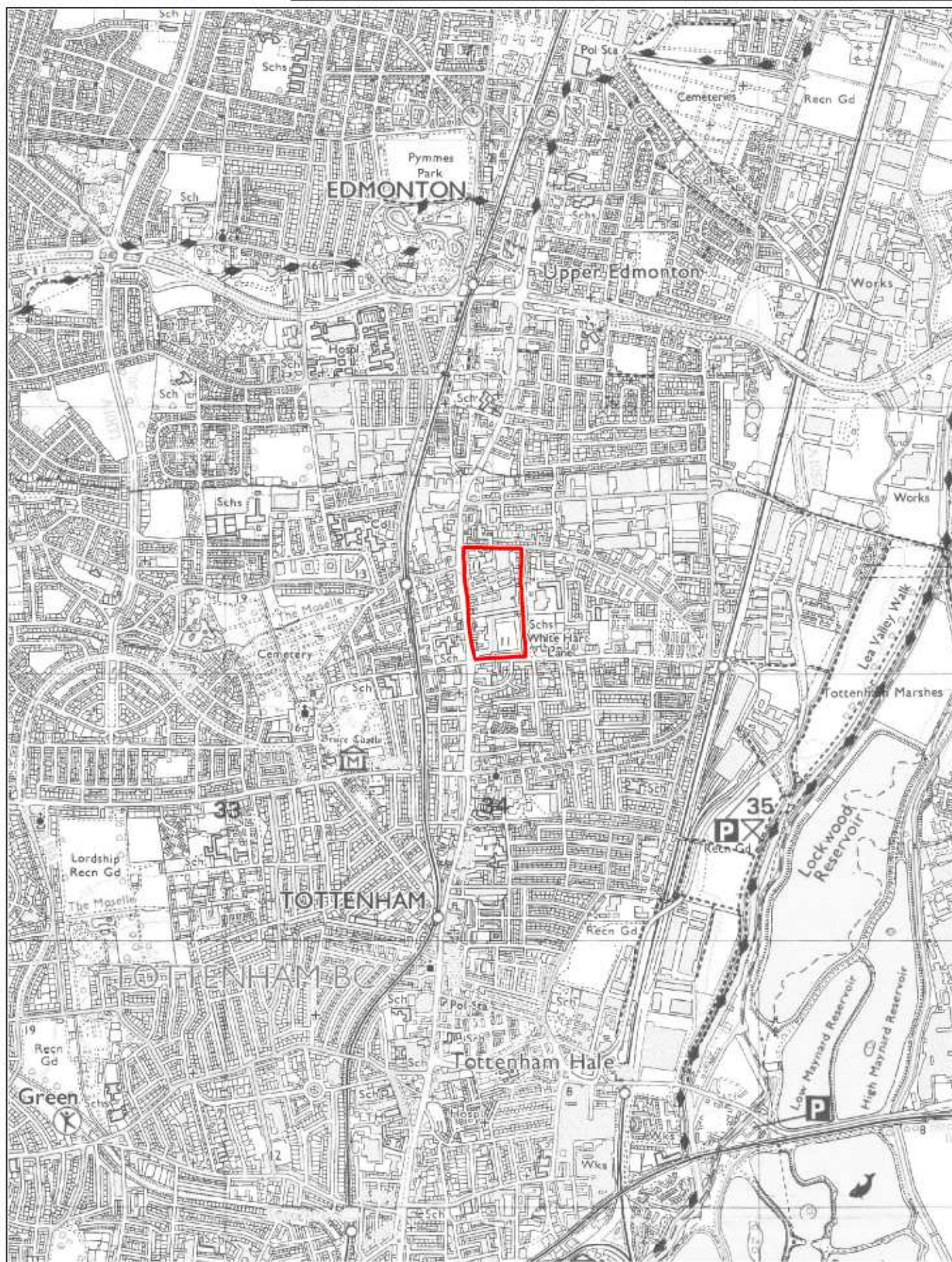
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FIGURES

FIGURE I // Site Area - General



— Site Area

0 640m

PROJECT // 0627L- Northumberland Road

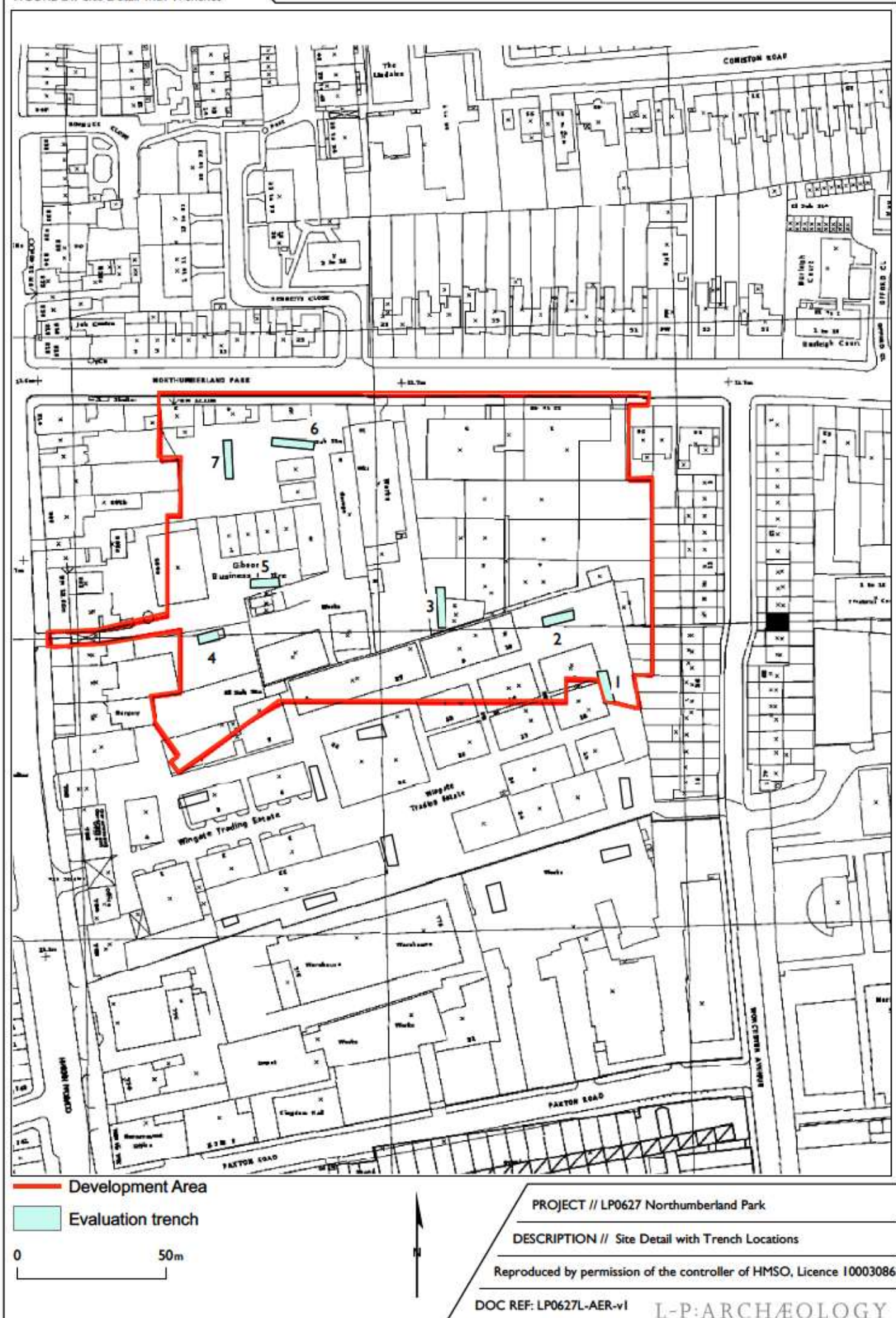
DESCRIPTION // Site Location - General

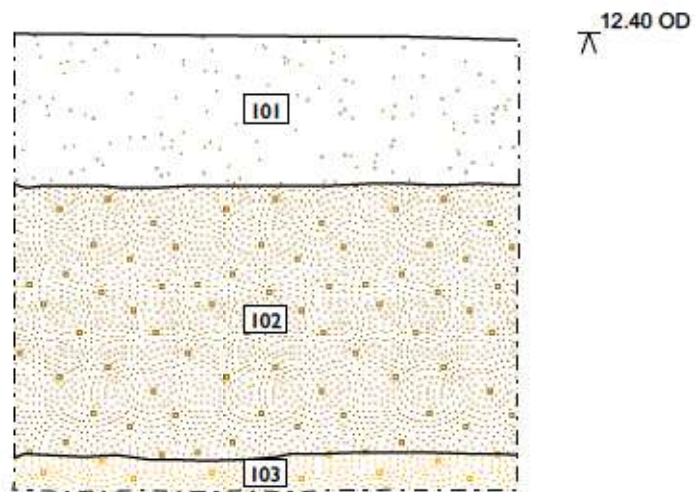
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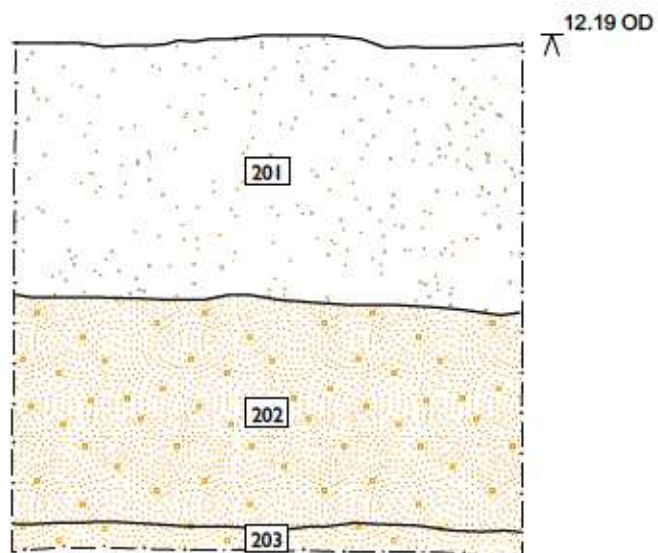
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FIGURE 2 // Site Detail with Trenches





Trench 1 South West Facing



Trench 2 North West Facing

0 1 m



PROJECT // 0627L- Northumberland Park

DESCRIPTION // Representative Sections Trenches 1 and 2

Produced by L - P: Archaeology

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