NORTH LONDON WASTE AUTHORITY

NORTH LONDON HEAT AND POWER PROJECT

ENVIRONMENTAL STATEMENT: VOLUME 2 APPENDICES 3.1 AND 3.2

AD06 . 02

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NORTH LONDON WASTE AUTHORITY

NORTH LONDON HEAT AND POWER PROJECT

ENVIRONMENTAL STATEMENT: VOLUME 2 APPENDIX 3.1 ARCHAEOLOGY ASSESSMENT METHODOLOGY

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Environmental Statement Volume 2 Appendix 3.1 Archaeology Assessment Methodology

AD06.02

The Planning Act 2008 The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5 (2)(a)

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1 Archaeology Assessment Methodology

1.1 Introduction

1.1.1 This appendix sets out the methodology for assessing the likely significant effects of the Project on archaeology.

1.1.2 Built heritage has been scoped out of the EIA as no potentially significant effects on built heritage assets have been identified during desk-based assessment within the Application Site or wider study area. This has been agreed with Historic England as described in Section 1.2 below.

1.1.3 The appendix is divided into the following parts:

a. engagement – describing a summary of comments on archaeology included in the Scoping Opinion, on the Preliminary Environmental Information Report[1] (PEIR), and further stakeholder engagement;

b. legislation and guidance – detailing requirements of the relevant National Policy Statements (NPS) and how these have been addressed, and additional guidance relevant to the archaeology assessment;

c. methodology for establishing baseline conditions; and

d. methodology for the assessment of construction, operation, decommissioning and cumulative effects.

1.2 Engagement

1.2.1 The Scoping Report recommended that archaeology and cultural heritage be scoped out from the Environmental Impact Assessment (EIA). The Scoping Opinion[2] did not however agree as insufficient detail was available regarding the Project for the potential impacts on archaeology to be adequately assessed. Based on the Scoping Opinion and further engagement with Historic England, archaeology has been scoped into the EIA to assess the effects of the Project on potential archaeology.

1.2.2 Vol 2 Appendix 3.1 Table 1 provides a review of the engagement and responses in relation to archaeology, including the decision to include archaeology in the EIA scope, and exclude built heritage.

Vol 2 Appendix 3.1 Table 1: Archaeology and built heritage engagement – comments and responses

Organisation and date	Comment	Response
Greater London Archaeological Advisory Service (GLAAS) (October 2014)	A Scoping Report was produced after discussions were held with GLAAS in July 2014 concerning the heritage potential of the Application Site and proposed works in connection with the Project. GLAAS advised that an archaeological desk-	In the Scoping Report it was proposed that archaeology and built heritage be scoped out of the EIA.

[1] North London Waste Authority (2015) Preliminary Environmental Information Report Issue for Consultation, May 2015

[2] The Planning Inspectorate (2014) Scoping Opinion Proposed North London Heat and Power Project, November 2014

Organisation and date	Comment	Response
	based assessment (DBA) should be submitted to inform the relevant planning decisions (including any geotechnical survey results available). The DBA concluded that due to the low value of potential archaeological remains on-site and the negligible effect on built heritage, there would be no significant archaeological or built heritage effects resulting from the proposed development.	
Scoping response: Secretary of State (November 2014)	The Scoping Opinion provided by the Secretary of State taking account of statutory consultees advised that archaeology and built heritage could be scoped out, provided that Historic England (HE) (formerly known as English Heritage) agreed.	Further engagement undertaken with HE to discuss.
Scoping response: Historic England (November 2014)	HE's Scoping Report response concluded that scoping out further archaeological and cultural heritage investigations was "premature". HE recommended the use of Museum of London's geoarchaeological study of the lower Lea Valley (2011) and other recent geoarchaeological work to further consider the potential effects. HE also mentioned the potential impact on the setting of Chingford Mill which cannot be adequately assessed due to the lack of full design details	Further engagement undertaken with HE to discuss.
Historic England (February 2015)	During engagement HE advised of the requirement for further assessment to be undertaken to determine whether the areas of below ground works would be likely to affect potential archaeology. The further assessment was defined as: • A geoarchaeological modelling study (to analyse areas of potential archaeology that may coincide with the below ground works) resulting in contour plans of archaeological 'hot spots'. • Integration of the results of existing borehole data, supplemented by open source data from the British Geological Survey. Additionally, HE requested an additional viewpoint from Chingford Mill Pumping Station (Grade II) to enable the setting of the listed building to be determined.	The agreed geoarchaeological study was undertaken (April 2015). A viewpoint was added to the visual assessment for Chingford Mill. However as noted below, assessment of effects on built heritage was alter agreed to be scoped out. The archaeological DBA was prepared.
Historic England (June 2015)	Meeting held with HE to discuss the findings of the geoarchaeological modelling study and DBA presented in the PEIR. HE advised they were considering the documents and would provide feedback as soon as possible.	N/A
Historic England (July 2015)	HE confirmed agreement to scoping out of built heritage but not archaeology. They concluded that there is a risk of a significant adverse effects on buried heritage assets and that mitigation measures would be likely to be needed.	Archaeology included in scope of EIA and a section is included in the ES (Vol 2 Section 3) accordingly.

Organisation and date	Comment	Response
Historic England (July 2015)	HE confirmed effects on the western, south-eastern and southern areas of the Application Site; offering the greatest potential for preserving proxy-environmental indicators. and material for radiocarbon dating), for tracking the changing prehistoric / historic environment over time) will need most careful consideration, with the piling being the primary concern. HE recommended reviewing piling guidance for determining whether there could be significant effects, and therefore whether further evaluation is warranted.	The effects on these areas have been carefully considered and are included in the assessment contained in Vol 2 Section 3.

1.3 Legislation and guidance

1.3.1 Policy with regard to nationally important energy projects is laid out in the Overarching National Policy Statement (NPS) for Energy (EN-1) and NPS for Renewable Energy Infrastructure (EN-3) (see Vol 2 Appendix 3.1 Table 2).

Vol 2 Appendix 3.1 Table 2: Historic Environment NPS EN-1 requirements

Requirements of NPS EN-1	How the requirement is addressed	Location of where to find further detail
Paragraph 5.8.4 details "*heritage assets with archaeological interest that are not currently designated as scheduled monuments, but which are demonstrably of equivalent significance*." There should be compliance with paragraph 5.8.5 for the following assets. • "'*those that have yet to be formally assessed for designation*"; • "*those that have been assessed as being designatable but which the Secretary of State has decided not to designate*"; • "*those that are incapable of being designated by virtue of being outside the scope of the Ancient Monuments and Archaeological Areas Act 1979*."	Archaeological assets subject to these criteria have been assessed in the archaeological assessment.	See Baseline Section 3.5 in the archaeological assessment
• Para 5.8.5 – The absence of designation for heritage assets "*does not indicate lower significance. If the evidence before the IPC indicates to it that a non-designated heritage asset of the type described in Para 5.8.4 (see below) may be affected by the proposed development then the heritage asset should be considered subject to the same policy considerations as those that apply to designated heritage assets."*	Non-designated assets have been considered in the assessment and described in detail in Appendix B2 of the DBA (Vol 2 Appendix 3.2)	Section 3 of the DBA (Vol 2 Appendix 3.2)
• Para 5.8.6 – "*The IPC should also consider the impacts on other non-designated heritage assets, as identified either through the development plan making process (local listing) or through the IPC's decision making process on the basis of clear evidence that the assets have a heritage*	Assets subject to these criteria have been considered as part of the archaeological assessment and geoarchaeological model.	Section 3 of the DBA (Vol 2 Appendix 3.2) and the geoarchaeological

Requirements of NPS EN-1	How the requirement is addressed	Location of where to find further detail
significance that merits consideration in its decisions, even though those assets are of lesser value that designated heritage assets."		deposit model (Appendix E of Vol 2 Appendix 3.2)
• Para 5.8.8 – "*As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset. As a minimum the applicant should have consulted the relevant Historic Environment Record and assessed the heritage assets themselves using expertise where necessary according to the proposed development's impact."*	A description of the significance of the heritage assets affected by the proposed development, as well as the contribution of their setting, is described in the archaeological assessment. Assets have been collated using various sources including, but not limited to, HER data. The assessment was undertaken by experienced archaeologists.	Table 5 of the DBA (Vol 2 Appendix 3.2)
• Para 5.8.9 – "*Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate DBA and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where the proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact*."	A DBA has been undertaken for the Project. The DBA was deemed to be sufficient and field evaluation was not carried out. Visualisations have been prepared as part of the Visual Assessment (ES Volume 3). It has been agreed with HE that the settings of heritage assets would not be affected.	Appendix D3 of the DBA and the geoarchaeological deposit model Figures 2 – 12 (Vol 2 Appendix 3.2)
• Para 5.8.10 – "*The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documentation."*	The archaeology section of the ES (Vol 2 Section 3) and supporting appendices clearly describe the effects and significance on heritage assets.	Vol 2 Appendix 3.1 (this document), Vol 2 Appendix 3.2 (DBA) and Appendix E of Vol 2 Appendix 3.2 (geoarchaeological deposit model.
• Para 5.8.11 – " *the following*: • *evidence provided within the application*; • *any designation records*;	All these criteria are taken into account in the archaeological assessment.	Vol 2 Section 3 and this methodology appendix.

Requirements of NPS EN-1	How the requirement is addressed	Location of where to find further detail
• *the Historic Environment Record, and similar sources of information*; • *the heritage assets themselves*; • *the outcome of consultations with interested parties*; and • where appropriate and when the need to understand the significance of the heritage asset demands it, expert advice."	Appropriate archives, information and experts have been consulted.	
• Para 5.8.12 – "*In considering the impact of a proposed development on any heritage assets, the IPC should take into account the particular nature of the significance of the heritage assets and the value that they hold for this and future generations. This understanding should be used to avoid or minimise conflict between conservation of that significance and proposals for development*."	Significance taken into account in the assessment and documented using a defined methodology. Measures to prevent and reduce adverse effects are included in the CoCP.	Vol 2 Section 3.6 and Section 6 of the CoCP (Vol 1 Appendix 3.1.
• Para 5.8.13 – "*The IPC should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution they can make to sustainable communities and economic vitality. The IPC should take into account the desirability of new development making a positive contribution to the character and local distinctiveness of the historic environment. The consideration of design should include scale, height, massing, alignment, materials and use. The IPC should have regard to any relevant local authority development plans or local impact report on the proposed development in respect to the following factors*: • *heritage assets having an influence on the character of the environment and an area's sense of place; and* • *heritage assets being a stimulus to inspire new development of imaginative and high quality design*".	Relevant heritage assets have been reviewed in the assessment and the necessary steps taken to protect the assets: • targeted geo-archaeological boreholes on selected proposed pile locations; • watching brief during excavations for storage bunker; and • watching brief during site preparation for construction of RRF and EcoPark House.	Vol 2 Sections 3.7 and 3.8 and Section 6 of the CoCP (Vol 1 Appendix 3.1).

1.3.2 In regards to NPS EN-3 requirements, there are no relevant historic environment requirements. It has therefore not been considered further in this assessment.

Legislation and guidance

1.3.3 The criteria that determine the fundamental requirements that allows heritage to be protected stem from legislation and guidance. Accepted criteria have been used in this assessment for recognising and assessing the effects on valuable heritage assets.

1.3.4 Statutory protection for archaeology is principally provided by the Ancient Monuments and Archaeological Areas Act of 1979 amended by the National Heritage Act (2002). The Secretary of State for National Heritage maintains a schedule of Nationally Important sites; criteria for designation as such are:

a. extent of survival;
b. current condition;
c. rarity;
d. fragility;
e. connection to other monuments, or group value;
f. potential to contribute to our information, understanding and appreciation; and
g. extent of documentation enhancing the monument's significance.

1.3.5 The Chartered Institute for Archaeologists (CIfA) provides guidance for historic environment Desk-Based Assessments. This guidance was adopted as approved practice in 1994 and updated in December 2014[3]. It provides a robust platform with which minimum standards are set out and expected. The assessment followed the recommendations of the guidance to ensure that the fundamental data sources were included and adequately assessed.

1.3.6 It states:

"A desk based assessment will:

- *determine, as far as is reasonably possible from existing records, the nature, extent and significance of the historic environment within a specified area;*
- *be undertaken using appropriate methods and practices which satisfy the stated aims of the project, and which comply with the Code of conduct, Code of approved practice for the regulation of contractual arrangements in field archaeology, and other relevant by-laws of the IfA; and*
- *establish the impact of the proposed development on the significance of the historic environment (or will identify the need for further evaluation to do so), and will enable reasoned proposals and decisions to be made whether to mitigate, offset or accept without further intervention that impact."*

1.3.7 Further guidance provided by the Greater London Archaeological Advisory Service (GLAAS), through *Guidelines for Archaeological Projects in Greater London* (the 'Guidelines')[4] has also informed the preparation of the desk-based assessment (Vol 2 Appendix 3.2). The Guidelines provide standards regarding minimum requirements for 'archaeological and

[3] Chartered Institute for Archaeologists (2014) Standard and Guidance for Historic Environment desk Based Assessment.
[4] GLAAS (April 2015) *Guidelines For Archaeological Projects in Greater London.*

historical background' information (i.e. data sources that need to be consulted, and the inclusion of cartographic elements) and how to go about including elements such as information acquired from historic documents. Also the document, provides advice on incorporating geotechnical investigations and set the standards required for inclusion of geoarchaeological information.

1.3.8 A site walk over is also recommended in the Guidelines. However after a site visit, a walk over was deemed unnecessary in order to robustly assess the effects of the Project on archaeology.

1.3.9 The Greater London Archaeological Advisory Service's *Standards for Archaeological Work*[5] provides a chapter on desk-based assessments detailing best-practices. This informed the preparation of the desk-based assessment (Vol 2 Appendix 3.2).

1.3.10 English Heritage's *The Setting of Heritage Assets*[6], provided a basis on which to determine whether the Project would impact the setting of any heritage assets, detailing what is included in 'settings' in general and in highlight the ways that settings can be impacted.

1.3.11 Historic England's *Piling and Archaeology Guidelines and Best Practice*[7], offers information on the impacts of common types of piling on archaeology and the effects it can have. This was used to inform the assessment.

1.3.12 The Design Manual for Roads and Bridges (DMRB) section on Cultural Heritage[8] has been used to develop the methodology for assessing the impact of the Project on heritage assets. The DMRB directs an assessment to clearly establish the value of the affected assets, the impact of the scheme and determine satisfactory mitigation measures or enable the need for mitigation to be discounted[9].

1.4 Baseline conditions

Current baseline

1.4.1 Baseline archaeological information has been derived from a variety of archaeological and cultural heritage surveys and data sources. This comprises Historic Environment records, mapping regression analysis, and previous archaeological activity information. For further details, please refer to Vol 2 Appendix 3.2, Appendices C, D and E.

1.4.2 A geoarchaeological deposit model (Appendix E of Vol 2 Appendix 3.2) has been prepared using data from site investigations carried out in 2011, 2012 and 2014.

[5]The Greater London Archaeological Advisory Service (2009) Standards for Archaeological Work

[6] English Heritage (2011) The Setting of Heritage Assets

[7] Historic England (June 2015) Piling and Archaeology Guidelines and Best Practice

[8] Highways Agency (2007) Design Manual for Roads and Bridges Volume 11, Section 3, Part 2 'Cultural Heritage'

[9]DMRB (2001) Vol 11, section3 , part 2 HA 208/07 Cultural Heritage: The Assessment Process 3.7, http://www.standardsforhighways.co.uk/dmrb/vol11/section3/ha20807.pdf; Accessed 19/08/2015

1.4.3 The deposit model characterises the geological deposits on the Application Site and has been used to assess the potential of these deposits to provide information of archaeological or palaeoenvironmental value.

1.4.4 The assessment comprises an examination of readily available published and unpublished written records, illustrations, maps and archaeological and geological records. Information was sourced from the GLHER, and through online historical resources (such as http://www.british-history.ac.uk and http://www.victoriacountyhistory.ac.uk) and the Archaeological Data Service (ADS).

1.4.5 Historic Ordnance Survey 1:10,560, 1:2,500 and 1:1,250 maps from the 19th century onwards have been examined to gain an understanding of the development of the assessment area, and how this may affect the potential for buried archaeological assets to survive[10].

Assessment area

1.4.6 Heritage assets within 1km of the centre of the Application Site have been examined and are described noted in the baseline (Vol 2 Section 3.5). The distance of 1km allows an insight into the historical character of the wider area, which provides information on the potential archaeology within the Application Site.

Future baseline

1.4.7 For the purposes of this assessment, the future baseline is assumed to be the same as the current baseline, due to the nature of archaeology changing very little over long periods of time.

Receptor identification and sensitivity

1.4.8 The varying effects of a development on individual receptors (heritage assets) depend upon the importance (value) and sensitivity of the receptor. Receptors include any archaeological remains encountered, including but not limited to, remains of people, animals, plant, structures, implements or natural resources.

1.4.9 Receptors outside the Application Site boundary are also considered for their ability to indicate the characteristic of the area and the potential for similar finds within the Application Site.

1.4.10 There is no specific guidance published by either the CIfA or HE for assessing the environmental value of heritage assets. In the absence of this, the assessment has been carried out in accordance with the DMRB[11].

1.4.11 Vol 2 Appendix 3.1 Table 3 summarises the criteria used for the determination of the environmental value of heritage assets. The value categories have been defined using the DMRB guidelines, but the typical

[11] Highways Agency (2007) *Design Manual for Roads and Bridges* Volume 11, Section 3, Part 2,'Cultural Heritage', Chapter 5, Section 5.10 'Evaluating the Archaeological Resource'

descriptions are only suggestions and professional judgement and knowledge have been used to apply values.

Vol 2 Appendix 3.1 Table 3: Factors for assessing environmental value of heritage assets

Value	Typical descriptors
Very High	World heritage sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives
High	Nationally important assets (scheduled monuments, Grade I and II* listed buildings, Grade I registered parks and gardens). Assets with the potential to contribute to national research objectives.
Medium	Designated (conservation areas, Grade II listed buildings, Grade II registered parks and gardens) or non-designated assets that are of regional importance. Assets with the potential to contribute to regional research objectives.
Low	Assets of local importance (locally listed buildings). Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives.
Negligible	Assets with very little or no surviving archaeological interest.

1.5 Construction effects

Assessment of Project stages

1.5.1 The Project is divided into four stages, of which Stage 1 and Stage 3 are when most construction-related activities which may affect archaeology due to intrusive ground works would occur, while Stage 2 and Stage 4 are essentially operational and would not affect archaeology. Therefore no assessment of effects from Stages 2 and 4 coving operations has been undertaken.

Assessment method

1.5.2 Determining the nature and location of impacts from construction has been achieved by analysing the Project to identify which areas would be disturbed by intrusive development. Impacts would vary depending on the type of intrusion occurring. For the Project, this includes:

a. excavation of foundations;

b. slab construction and;

c. construction of piled foundations.

1.5.3 Impacts from piled foundations would vary depending on quantity and density.

1.5.4 The potential areas of impact have then been referenced against likely archaeological potential (based on the results of the desk-based assessment (Vol 2 Appendix 3.2) and geoarchaeological deposit model) to identify impacts.

Attributing significance

1.5.5 The significance of effects is a function of the environmental value of the affected asset combined with the magnitude of change.

Magnitude of change criteria

1.5.6 Having established the environmental value of the assets affected, the magnitude of change was then established. Vol 2 Appendix 3.1 Table 4 defines the type of change and its magnitude, according to the DMRB methodology.

Vol 2 Appendix 3.1 Table 4: Magnitude of change criteria

Magnitude of change	Description of change
Major	Complete destruction/demolition of site or feature. Change to the Application Site or feature resulting in a fundamental change in our ability to understand and appreciate the resource and its historical context and setting.
Moderate	Change to the Application Site or feature resulting in an appreciable change in our ability to understand and appreciate the resource and its historical context and setting.
Minor	Change to the Application Site or feature resulting in a small change in our ability to understand and appreciate the resource and its historical context and setting.
Negligible	Negligible change or no material change to the Application Site or feature. No real change in our ability to understand and appreciate the resource and its historical context and setting.
No Change	No change

1.5.7 The CoCP (Vol 1 Appendix 3.1) sets out minimum standards of construction practice required of the Contractor and the Applicant. It sets out a series of control measures and standards of work that would be applied throughout the construction period to eliminate and control potential impacts and provides a mechanism to engage with stakeholders.

1.5.8 As a core part of the Project, the CoCP (Vol 1 Appendix 3.1) has been considered in the initial assessment, with any supplementary mitigation being identified for the assessment of residual effects.

Significance criteria

1.5.9 Where effects may occur on archaeological resources, significance has been attributed using the methodology from DMRB[9] through consideration of both the ‘Environmental value’ and ‘Magnitude of change. Vol 2 Appendix 3.1 Table 5 presents a matrix for combining these two factors.

Vol 2 Appendix 3.1 Table 5: Significance of effect

		MAGNITUDE OF CHANGE				
		No Change	Negligible	Minor	Moderate	Major
ENVIRONMENTAL VALUE	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

1.5.10 In regards to establishing the significance of effects, when the matrix provides a choice of two outcomes (e.g. Neutral or Slight), professional judgement has been used to determine the outcome, informed by past archaeological investigations, geoarchaeological deposit models and the desk-based assessment (Vol 2 Appendix 3.2).

1.6 Operational effects

1.6.1 Archaeological assets would be affected only where intrusive ground works are undertaken. Operations would therefore not affect archaeology and the assessment of effects from operations are not considered.

1.7 Decommissioning effects

1.7.1 The effects of decommissioning on archaeological material have been assessed using the same methodology as applied for the construction assessment. The effects have been determined by identifying the areas that possess high archaeological potential, and considering the works that would occur that would disturb those areas. The assessment of significance has been applied in the same way as described in Section 1.5.

1.8 Cumulative effects

1.8.1 Using the development schedule contained in Vol 1 Appendix 5.2, developments have been highlighted based on their potential to give rise

to significant cumulative effects on archaeology. This potential is based on a development's proximity, size and possibility of groundwork involved as well as the characteristics of archaeological assets impacted. The following developments have been noted in terms of their potential for cumulative effects:

a. The North London (Electricity Line) Reinforcement (DCO);
b. Meridian Water;
c. Pegamoid Works;
d. Stonehill Estate; and
e. Lee Valley Heat Network and Energy Centre.

1.8.2 Cumulative effects have been identified by considering if the assessment would change when considered in combination with the identified developments.

1.8.3 The cumulative effects assessment is based on the assumption that excavation and structural works for the identified developments would not be deeper than typical similar sized structures, i.e. not exceeding 8-10 m OD (metres above Ordnance Datum), and would remain use typical piling methods, as described by Historic England[12].

[12] Historic England, Piling and Archaeology, Guidelines and Best Practice, June 2015, p7-15

NORTH LONDON WASTE AUTHORITY

NORTH LONDON HEAT AND POWER PROJECT

ENVIRONMENTAL STATEMENT: VOLUME 2 APPENDIX 3.2 ARCHAEOLOGY DESK-BASED ASSESSMENT

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North London Heat and Power Project

Archaeological Desk-Based Assessment

Issue for Consultation

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ARUP

Contents

Glossary

ADS	Archaeology Data Service
BGL	Below Ground Level
GLAAS	Greater London Archaeological Advisory Service
GLHER	Greater London Historic Environment Record
NMR	National Monument Record

Executive Summary

This desk based historic environment assessment has been commissioned by North London Waste Authority in connection with the proposed North London Heat and Power Project at Advent Way, London, N18 3AG, in the London Borough of Enfield.

While the Application Site is known to be located in an area of high archaeological potential, its location within the floodplain of the River Lea makes it unlikely that settlement remains pre-dating the medieval period would be present although deposits which may yield evidence of the past environment may be present.

Site investigation works undertaken between 2011 and 2014 indicate that substantial truncation has occurred as a result of the construction of sludge lagoons on the northern part of the Application Site. Truncation on the remainder of the site was less severe with the highest level of archaeological survival to be found in the southernmost part of the site.

A geo-archaeological deposit model has been prepared utilising data from the site investigation works. Three landscape zones (LZ's) each with varying levels of archaeological and palaeoenvironmental potential have been identified across the site. LZ 1 is situated on the northern part of the site within the vicinity of the proposed Energy Recovery Facility (ERF). This zone should be regarded as being of low archaeological potential but moderate to high palaeoenvironmental potential including organic deposits within the basal gravel known as the Lea Valley Arctic Beds. LZ 2 is located predominately on the northern and central area of the site and extends as far south as the proposed Resource Recovery Facility (RRF). The zone has moderate palaeoenvironmental potential and low to moderate archaeological potential. LZ 3 is located on the western, south-eastern and southern areas of the site. Parts of the RRF fall within this zone. This zone has the highest palaeoenvironmental potential across the site as a whole and moderate archaeological potential.

It is concluded that the impact from the proposed Energy Recovery Facility (ERF) would be largely within modern made ground resulting from the present and previous use of the site. However the deeper excavation for the storage bunker within the ERF would penetrate the full depth of floodplain deposits and into the basal gravels. Excavations for the new foundation slabs for the Resource Recovery Facility (RRF) and the EcoPark house (located within LZ 2 and 3) may impact on the upper alluvial deposits. However, these deposits consist of inorganic alluvial clays and silts and are therefore of low palaeoenvironmental and archaeological potential. Some degree of piling is proposed for all three buildings which would impact locally on the deeper parts of the floodplain sequence. It is concluded that the construction of the ERF and its associated structures will not have a significant effect on the archaeological and palaeoenvironmental deposits present on the site. Less than significant effects may however result from the construction of certain elements of the proposed scheme. Although the effects are assessed to be less than significant it is nonetheless recommended that a programme of archaeological investigation be carried out to ensure that the heritage value from the deposits affected is appropriately recorded.

1 Introduction

1.1 Background to Project

1.1.1 Arup was commissioned by North London Waste Authority (NLWA) to undertake a historic environment desk-based assessment in respect of the North London Heat and Power Project (NLHPP) at Advent Way, London, N18 3AG (hereafter, the 'Application Site').

1.1.2 The Project primarily consists of:

- Demolition of existing Energy from Waste facility (EfW); and
- Construction of new Energy Recovery Facility (ERF) with associated development.

1.2 Location and status of site

1.2.1 The Application Site is located at Edmonton in the London Borough of Enfield at National Grid Reference: TQ 35760 92670 (site centred). The site is bounded by the River Lee Navigation to the east, Advent Way to the South, Salmons Brook (a minor watercourse) to the west and the former Deephams Sewage Works to the north.

1.2.2 The existing site covers approximately 15.9 hectares, with EfW buildings covering the majority of the central part of the site with the remainder of the site occupied by ash sifting, composting and other ancillary facilities primarily on the northern part of the site. The topography of the Application Site varies between 10.9m and 14.5m above Ordnance Datum (AOD) across the site sloping, in general, gently southward from 12m to 11m AOD.

1.2.3 The solid geology of the site comprises alluvium over London Clay[1].

1.3 Aims and objectives

1.3.1 The aim of the historic environment desk-based assessment is to provide an overview of readily available documentary data relating to the history and archaeological potential of the site. It also comprises establishing the environmental value of the heritage assets and the impact of the Project on the heritage assets within the assessment area[2].

1.4 Assumptions and limitations

1.4.1 Data used to compile this assessment consist of secondary information derived from a variety of sources, predominately the Greater London Historic Environmental Record (GLHER). It is assumed that this data, as well as that derived from other secondary sources, is accurate.

[1] (http://mapapps.bgs.ac.uk/geologyofbritain/home.html)
[2] See Section 2.4 for further detail on the assessment area.

1.4.2 The GLHER records known archaeological and historic assets. It is not an exhaustive record of all surviving historic assets and does not preclude the existence of further assets which are unknown at present.

2 Methodology

2.1 Legislation

2.1.1 Statutory protection for archaeology is principally provided by the Ancient Monuments and Archaeological Areas Act of 1979 amended by the National Heritage Act (2002). The Secretary of State for National Heritage maintains a schedule of Nationally Important sites. Criteria for designation as a Nationally Important site are:

- extent of survival;
- current condition;
- rarity;
- fragility;
- connection to other monuments, or group value;
- potential to contribute to our information, understanding and appreciation; and
- extent of documentation enhancing the monument's significance.

2.2 National policy

2.2.1 Policy with regard to nationally important energy projects is laid out in the Overarching National Policy Statement for Energy (EN-1)[3].

2.2.2 EN-1 recognises that the construction, operation and decommissioning of energy infrastructure has the potential to result in adverse impacts on the historic environment.

2.2.3 As part of any ES the applicant should provide a description of the significance of the heritage assets affected by the application proposals and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset.

2.2.4 Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation.

2.2.5 In considering applications, the Planning Inspectorate should seek to identify and assess the particular significance of any heritage asset that may be affected by the application proposals, including by development affecting the setting of a heritage asset.

[3] Department for Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1).

2.2.6 The Planning Inspectorate should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution they can make to sustainable communities and economic vitality. The Planning Inspectorate should take into account the desirability of new development making a positive contribution to the character and local distinctiveness of the historic environment. The consideration of design should include scale, height, massing, alignment, materials and use. The IPC should have regard to any relevant local authority development plans or local impact report on the application proposals.

2.2.7 Any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater the harm to the significance of the heritage asset the greater the justification will be needed for any loss. Where the application will lead to substantial harm to or total loss of significance of a designated heritage asset the Planning Inspectorate should refuse consent unless it can be demonstrated that the substantial harm to or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm.

2.2.8 Where the loss of the whole or a material part of a heritage asset's significance is justified, the Planning Inspectorate should require the developer to record and advance understanding of the significance of the heritage asset before it is lost. The extent of the requirement should be proportionate to the nature and level of the asset's significance. Developers should be required to publish this evidence and deposit copies of the reports with the relevant Historic Environment Record. They should also be required to deposit the archive generated in a local museum or other public depository willing to receive it.

2.2.9 Where appropriate, the Planning Inspectorate should impose requirements on a consent that such work is carried out in a timely manner in accordance with a written scheme of investigation that meets the requirements of this Section and has been agreed in writing with the relevant Local Authority (where the development is in English waters, the Marine Management Organisation and English Heritage[4], or where it is in Welsh waters, the MMO and Cadw)) and that the completion of the exercise is properly secured.

2.2.10 Where the Planning Inspectorate considers there to be a high probability that a development site may include as yet undiscovered heritage assets with archaeological interest, The Planning Inspectorate should consider requirements to ensure that appropriate procedures are in place for the identification and treatment of such assets discovered during construction.

[4] From 1 April 2015 Historic England.

2.3 Guidance

2.3.1 The Chartered Institute for Archaeologists (CIfA) provides guidance for historic environment desk-based assessment. This guidance was adopted as approved practice in 1994, updated in December 2014[5] and sets the standard that:

"*A desk based assessment will:*

- *determine, as far as is reasonably possible from existing records, the nature, extent and significance of the historic environment within a specified area;*
- *be undertaken using appropriate methods and practices which satisfy the stated aims of the project, and which comply with the Code of conduct, Code of approved practice for the regulation of contractual arrangements in field archaeology, and other relevant by-laws of the IfA; and*
- *establish the impact of the proposed development on the significance of the historic environment (or will identify the need for further evaluation to do so), and will enable reasoned proposals and decisions to be made whether to mitigate, offset or accept without further intervention that impact*."

2.3.2 Guidance on the assessment of the setting of heritage assets is set out in *The Setting of Heritage Assets*[6]. The document sets out guidance on managing change within the settings of heritage assets including archaeological remains and historic buildings, sites, areas and landscapes intended to assist implementation of planning policy. This guidance establishes the view that:

"The significance of a heritage asset derives not only from its physical presence and historic fabric, but also from the surroundings in which it is experienced".

2.4 Assessment area

2.4.1 All designated[7] and non-designated heritage assets within 1km of the Application Site centre have been examined and detailed within this desk-based assessment.

2.5 Documentary research

2.5.1 The assessment comprises an examination of readily available published and unpublished written records, illustrations, maps and archaeological and geological records. Information was sourced from the GLHER[8], and through online historical resources (such as http://www.british-

[5] Chartered Institute for Archaeologists (2014) Standard and Guidance for Historic Environment desk Based Assessment.
[6] English Heritage (2011) The Setting of Heritage Assets
[7] See Figure 3 at Appendix A.
[8] The results of the GLHER search are presented at Appendix B

history.ac.uk and http://www.victoriacountyhistory.ac.uk) and the Archaeological Data Service (ADS).

2.5.2 Historic Ordnance Survey 1:10,560, 1:2,500 and 1:1,250 maps from the 19th century onwards have been examined to gain an understanding of the development of the assessment area, and how this may affect the potential for buried archaeological assets to survive[9].

2.6 Site walkover

2.6.1 A site walkover has not been undertaken.

2.7 Stakeholder engagement

2.7.1 Discussions were held with the Greater London Archaeological Advisory Service (GLAAS) in July 2014 concerning the heritage potential of the site and proposed works in connection with the Project. GLAAS advised that an archaeological desk based assessment (DBA) should be submitted to inform the relevant planning decisions.

2.7.2 The DBA should include an assessment of any geotechnical survey results available. The assessment allows an informed decision to be made on the need for field evaluation of the site and need for the topic to be scoped into the EIA.

2.8 Geoarchaeological deposit model

2.8.1 A geoarchaeological deposit model has been prepared using data from site investigations carried out in 2011, 2012 and 2014.

2.8.2 The deposit model characterises the deposits on the Application Site and assesses the potential of these deposits to provide information of archaeological or palaeoenvironmental value[10].

2.8.3 The deposit model therefore informs the assessment of likely impacts from the Project on the deposits present on the site.

[9] The cartographic information is presented at Appendix D
[10] The Deposit Model is presented at Appendix E.

2.9 Assessment of significance

Environmental value of heritage assets

2.9.1 There is no specific guidance published by either the Chartered Institute for Archaeologists (CIfA) or Historic England for assessing the environmental value of heritage assets. In the absence of this, the assessment has been carried out in accordance with the Design Manual for Roads and Bridges[11]. Table 1 summarises the criteria used for the determination of the environmental value of heritage assets.

Table 1: Factors for assessing environmental value of heritage assets

Value	Typical descriptors
Very High	World heritage sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives
High	Nationally important assets (scheduled monuments, Grade I and II* listed buildings, Grade I registered parks and gardens). Assets with the potential to contribute to national research objectives.
Medium	Designated (conservation areas, Grade II listed buildings, Grade II registered parks and gardens) or non-designated assets that are of regional importance. Assets with the potential to contribute to regional research objectives.
Low	Assets of local importance (locally listed buildings). Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives.
Negligible	Assets with very little or no surviving archaeological interest.

[11] Highways Agency (2007) Design Manual for Roads and Bridges Volume 11, Section 3, Part 2 'Cultural Heritage', Chapter 5, Section 5.10 'Evaluating the Archaeological Resource'

Magnitude of change

2.9.2 The approach used to assess significance of impact is determined by two variables; the environmental value of the asset, as described in Table 1 and the magnitude of change upon the asset described in Table 2. This takes into account the severity of impact from the proposed activity.

2.9.3 Table 2 summarises the type of change and its magnitude, according to the DMRB methodology[11].

Table 2: Magnitude of change

Magnitude of change	Description of change
Major	Complete destruction/demolition of site or feature. Change to the site or feature resulting in a fundamental change in our ability to understand and appreciate the resource and its historical context and setting.
Moderate	Change to the site or feature resulting in an appreciable change in our ability to understand and appreciate the resource and its historical context and setting.
Minor	Change to the site or feature resulting in a small change in our ability to understand and appreciate the resource and its historical context and setting.
Negligible	Negligible change or no material change to the site or feature. No real change in our ability to understand and appreciate the resource and its historical context and setting.
No Change	No change

Significance of effect

2.9.4 In accordance with the DMRB methodology, the significance of effect upon the cultural heritage resources is assessed according to the matrix approach described by Table 3. The effects may be either adverse or beneficial, depending on the nature of the impact. It should be noted that the initial assessment is made for the proposed project without mitigation; in the event that mitigation is proposed the residual effect as a result of mitigation is determined separately. Where the matrix suggests more than one likely outcome, for instance slight or moderate, professional judgement is used to arrive at an appropriate result.

Table 3: Significance of effect

		MAGNITUDE OF CHANGE				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
ENVIRONMENTAL VALUE	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

3 Baseline

3.1 Introduction

3.1.1 The archaeological and built heritage baseline, including elements of the historic landscape, is discussed below.

3.1.2 Discussion of the historical and archaeological background uses approximate historical periods as defined by English Heritage[12] and listed below in Table 4.

Table 4: Definition of archaeological time periods

Period name	Date range	Additional periods, where needed
Palaeolithic	500,000 – 10,000BC	
Mesolithic	10,000 – 4,000BC	
Neolithic	4,000 – 2,200BC	
Bronze age	2,200 – 700BC	
Iron age	700BC – AD43	
Romano-British	AD43 - 410	
Early medieval (Anglo-Saxon)	410 - 1066	
Medieval	1066 - 1540	
Post-medieval	1540 - 1901	Tudor - 1485 - 1603 Elizabethan - 1558 - 1603 Stuart - 1603 – 1714 (Jacobean 1603 – 1625) Hanoverian - 1714–1837 (Georgian 1714– 830) Victorian - 1837 - 1901
20th Century	1901 - 2000	
21st Century	2001 - 2100	

3.1.3 Heritage assets within the assessment area are listed in Table 9 and Table 10 in Appendix B and are shown on Figures 2 and 3 in Appendix A.

[12] (http://pastscape.org.uk/TextPage.aspx)

3.2 Designated heritage assets in the assessment area

3.2.1 There are no scheduled monuments, listed buildings, local listed buildings, battlefields, world heritage sites or registered parks and gardens within the Application Site.

3.2.2 Within the assessment area, there are three designated heritage assets:

- Chingford Mill Pumping Station;
- Chingford Mill Pumping Station Turbine Hall; and
- Railings at Chingford Mill Pumping Station.

3.2.3 Further details are provided in Table 9, Appendix B.

3.3 Historical background

3.3.1 The site is located in the former Edmonton Marsh which formed a band about 800m wide along the River Lea, bordered and crossed by many watercourses. In 894 a Viking fleet made its way up the river to Hertford however for most of the medieval period river traffic was limited by the marshy nature of its banks[13].

3.3.2 It is suggested that the original Saxon settlement at Chingford was in the extreme south-west of the parish. This theory is supported by the fact that the medieval manor houses of Chingford St Pauls and Chingford Earls were both in this part of the parish.

3.3.3 The manor of Chingford St Pauls was already established on the Essex side of the river, 500m to the east of the site by 1066. It was held by the Dean and Chapter of St Pauls throughout the medieval period. Chingford St Pauls was one of a group of manors which supported the canons' household (communa). These manors were leased to farmers, who were required to furnish provisions in kind or in cash.

3.3.4 At the time of the Doomesday survey (1086) the Hundred[14] of Edmonton comprised the manors of Enfield, Tottenham, and Edmonton. The early settlements within the manor of Edmonton were sparse and concentrated along the line of the modern Fore Street approximately 1.5km west of the Application Site[15]. Upper and Lower Edmonton were served by open-field systems mostly west of Fore Street. More open fields probably lay to the north, primarily serving the manorial demesne farm[16].

[13] 'Edmonton: Introduction', *A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham* (1976), pp. 130-133. URL: http://www.british-history.ac.uk/report.aspx?compid=26931 Date accessed: 31 July 2014.

[14] A hundred is a geographic division formerly used in England, Wales, South Australia and some parts of the United States, to divide a larger region into smaller administrative divisions

[15] Weinreb et al (2008) p265

[16] 'Edmonton: Growth before 1851', A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham (1976), pp. 137-142. URL: http://www.british-history.ac.uk/report.aspx?compid=26933 Date accessed: 31 July 2014

3.3.5 In the medieval period there were several moated farm-houses, mainly east of Fore Street. One such was the moated manor named after Roger de Depeham thought to lie 600m north of the Application Site. The marshes on the alluvium by the Lea consisted of about 162 ha (400 acres) which, like the common fields, were divided into many small strips and open for common pasture from Lammas to Lady Day[17].

3.3.6 From the 16th century population growth in the manor was continuous but still largely confined to Upper and Lower Edmonton and the smaller hamlets of Winchmore Hill and Southgate. The population was approximately 600 in 1547 rising to 5,093 by 1801[18].

3.3.7 An Act of 1571 authorized the City of London to make the Lea navigable as far as Ware (Herts.). The New Cut, as it was called, was used for barges, mostly transporting grain from Hertfordshire to London.

3.3.8 Until the later part of the 19th century there was no fixed crossing of the river Lea. Water Lane, the road which led eastwards from Upper Edmonton, met the River Lea a short distance to the south east of the site at Cook's Ferry.

3.3.9 The course of the River Lea was obliterated by the construction of Banbury reservoir (completed 1904) in southern Edmonton and Tottenham and by the much larger William Girling Reservoir (completed 1951) in Edmonton and Enfield.

3.3.10 The common fields of Edmonton parish were enclosed in 1804 greatly altering the appearance of the landscape (particularly in the eastern half of the parish[19]). However the greatest effect on settlement pattern within the parish was as a result of arrival of railways. The first lines were laid in the 1840s and in 1872 the Great Eastern Railway (GER) completed a line through Lower Edmonton. Some of the population that was displaced by the construction of the GER terminus at Liverpool Street Station, which opened in 1874, settled in Edmonton. Improvements in transport and the possibility of cheap housing saw a substantial rise in the numbers of dwellings in the later part of the 19th century[20].

3.3.11 The flood prone nature of the area adjacent to the Lea Navigation resulted in development being slower in this area than on the drier ground to the west. In the 1870s the area of the Application Site was still open marshland, although the first traces of industrialisation of the landscape

[17] 'Edmonton: Economic history', A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham (1976), pp. 161-172. August 1 is Lammas Day (Anglo-Saxon *hlaf-mas*, "loaf-mass"), the festival of the wheat harvest, and is the first harvest festival of the year. Lady Day is the traditional name of the Feast of the Annunciation of the Blessed Virgin (25 March).

[18] 'Edmonton: Growth before 1851', A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham (1976), pp. 137-142. URL: http://www.british-history.ac.uk/report.aspx?compid=26933 Date accessed: 31 July 2014

[19] 'Edmonton: Growth after 1851', A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham (1976), pp. 142-149

[20] The total in 1861 was 2,079 which by 1901 had risen to 10, 613.

were appearing with the establishment of the Angel Works of Messrs Ridley, Whitley and Co and the Tottenham and Edmonton Gas Works about 500m to the south of the Application Site (see Appendix D).

3.3.12 Eley's Cartridge Works had moved to a site immediately to the west of the Application Site by 1896 – the works expanded dramatically in the first decades of the 20th century before moving to Waltham Cross in 1921 (see Appendix D).

3.3.13 Completion of the North Circular Road in 1927 further encouraged industrialisation of the area. By 1938 the Application Site was surrounded to the west and south by a variety of factories producing furniture, wirelesses, zinc sheets, soda syphons and clothing.

3.3.14 A sewage works was established in the 1870s at Deephams Farm to the north of the Application Site. The works were expanded to the south in 1927 leading to the construction of filtration beds within 150m of the northern boundary of the Application Site (see Appendix D). By 1976 the sewage works had extended further south with the construction of sludge lagoons which overlapped the northern part of the Application Site (see Appendix D).

3.3.15 On the Essex side of the River Lea Chingford Pumping Station was built for the East London Waterworks Company in 1895[21]. In 1904 the Metropolitan Water Board took over the local water companies, including the new Banbury Reservoir on the borders of Tottenham. In 1935 work started on the very large William Girling Reservoir, which was finally completed in 1951.

3.3.16 In the years after World War Two the riverside in Edmonton declined into dereliction. Plans to transform the Lea riverside into a recreational area led by the Lee Valley Regional Park Authority began in 1967.The present development on the site commenced operations in 1971. It has been described by Nikolaus Pevsner[22] as being, *"…on the edge of the marshes, in a setting that enhances its impressive scale. Vast box-like forms clad in corrugated metal sheeting, pale grey and dark grey, approached by two big ramps on tapering piers…"*.

3.4 Archaeological background

Prehistoric

3.4.1 Flint tools and animal remains of Palaeolithic date have been found at several locations in the assessment area (see Table 7 in Appendix B and Figure 3 in Appendix A). These are "stray finds" representing material redeposited within river gravel laid down at a later date.

3.4.2 Mesolithic flint work was found during excavations at Montagu Road 500m to the north-west of the Application Site (MLO74). The Montagu Road site

[21] The Pumping Station , Turbine House and Railings of the 1895 works are now listed – see Table 9 in Appendix B.
22 Pevsner, Nikolaus; Bridget Cherry (1998). The Buildings of England, London 4: North. p. 426

lay on the edge of higher ground to the west of the marshy alluvium of the Lea valley and the site also yielded evidence for site clearance and occupation from the late Neolithic into the Iron Age.

3.4.3 Finds of Bronze Age metalwork comprising a spearhead, knife and shield were found in 'Edmonton Marsh' close to the site in the 19th century[23]. Excavations at Lower Hall Lane on the east bank of the River Lea uncovered Bronze Age cremations (MLO2408).

3.4.4 Peat and alluvium of prehistoric date has been identified at a number of sites in the assessment area.

Romano-British

3.4.5 Romano-British remains from the study area are confined to chances finds of coins (MLO258, MLO2735), a brooch fragment (MLO579) and a jar (MLO25877).

Early medieval (Anglo-Saxon)

3.4.6 A timber platform discovered at the Advent Way IKEA site 500m to the south of the Application Site has been interpreted as a crannog or artificial island. The platform was located within a subsidiary channel of the River Lea and was heavily eroded. Dendrochronology samples dated the timbers to the 5th century AD.

3.4.7 A sword of early medieval date was found 600m to the west of the site in 1911.

Medieval

3.4.8 Parts of the moat and ancillary structures associated with the manorial complex at Chingford St Paul's were uncovered during excavations by the Passmore Edwards Museum at Lower Hall Lane in 1988. The excavations failed to locate the hall which was thought to lie further to the south. The manorial complex lies approximately 400m-600m east of the Application Site.

3.4.9 Investigations at the Deephams Sewage Treatment works immediately to the north of the proposed site have uncovered ditches which may be associated with the manor of Roger de Depeham which is thought to lie 600m to the north. The site of the manor has yet to be located.

Post-medieval

3.4.10 No significant remains of post-medieval date have been investigated in the assessment area.

[23] These are located by the GLHER within Deephams's STW approximately 150m north of the proposed development site however in view of circumstances of their discovery it is unlikely that their actual findspot can be located with any precision.

20th century

3.4.11 No significant remains of 20th century date have been excavated in the study area. The 20th century development of the site as shown by the available historic mapping is discussed below in Section 3.7 and Appendix D.

3.5 Previous archaeological investigations

3.5.1 Twenty four archaeological investigations have been undertaken in the assessment area. Six of the interventions took place at Deephams Sewage Treatment Works between 2001 and 2010. The result of the work at Deephams has identified some drainage features associated with the medieval and later Deephams Manor Farm. Data derived from the archaeological investigations coupled with geotechnical ground investigation suggests significant levels of truncation in the western part of the Deephams site, but survival of alluvium and peat in the south-eastern part adjacent to the Application Site. South of the Application Site at Ravenside Retail Park a borehole survey indicated good survival of deposits with potential to contain archaeological remains. Geo-archaeological assessment at Advent Way to the south-west of the Application Site identified surviving Bronze Age peat however subsequent trial excavations failed to encounter any archaeological remains.

3.5.2 Excavations at a number of sites at Montagu Road in 1999 and 2000 produced evidence for Bronze Age and Iron Age ditches and enclosures.

3.5.3 There have been no archaeological investigations within the Application Site.

3.5.4 Further details are provided in Table 7, Appendix B.

3.6 Geoarchaeological potential of the Application Site

3.6.1 Utilising data gathered during geotechnical site investigations undertaken on the site in 2011, 2012 and 2014 the geoarchaeological deposit model identified three landscape zones (LZ's) each with varying levels of archaeological and palaeoenvironmental potential (see Deposit Model at Appendix E). LZ 1 is situated on the northern part of the site within the vicinity of the proposed ERF. This zone should be regarded as being of low archaeological potential but moderate to high palaeoenvironmental potential including organic deposits within the basal gravel known as the Lea Valley Arctic Beds. LZ 2 is located predominately on the northern and central area of the site and extends as far south as the proposed RRF. The zone has moderate palaeoenvironmental potential and low to moderate archaeological potential. LZ 3 is located on the western, south-eastern and southern areas of the site. Parts of the RRF fall within this zone. This zone has the highest palaeoenvironmental potential across the site as a whole and moderate archaeological potential.

3.6.2 The location of the site within the floodplain makes it unlikely that settlement remains pre-dating the medieval period are present; the

location being too wet for reasonable utilisation. The exploitation of Edmonton Marsh in the medieval period takes the form of isolated farmsteads such as that at Deephams. The probable location of these farmsteads is indicated by the farmsteads shown on the earliest Ordnance Survey mapping. The site lies at some distance from known farmsteads and it is likely that any features on the site would be drainage and enclosure features.

3.6.3 Floodplain sites may also preserve remains of features such as fish traps, weirs and other water management and exploitation features where waterlogged ground conditions are present. These are often preserved in very good condition. No such features have been uncovered in the study area however, if present on the site the channel edge deposits of LZ 3 is the most likely place for them to be encountered.

3.6.4 Finds made during construction of the nearby reservoirs and during construction of the North Circular show the potential of the floodplain deposits to yield individual items, especially metalwork. Such finds are however made extremely infrequently in the context of modern developments. In LZ 3 there is a moderate possibility of encountering early prehistoric material. Evidence for Mesolithic human activity may be encountered in prehistoric soils underlying the peats particularly in proximity to the deeper channel areas. Evidence is likely to take the form of materials relating to temporary occupation such as flint scatters, animal bone and burnt material.

3.6.5 Work at Deephams Sewage Treatment Works (STW) immediately north of the site has shown that previous activity associated with the operation of the STW on archaeological assets within the floodplain can result in substantial truncation, although pockets of deposits with archaeological potential may remain in situ.

3.6.6 Although settlement evidence is unlikely there is good potential to encounter deposits capable of yielding palaeo-environmental data. In LZ 1 the basal floodplain gravels may contain organic deposits that are known as the Lea Valley Arctic Beds. These relate to a cold period nearing the last glacial maximum and may preserve flora and fauna from 26,000 to 21,000 years ago. These deposits have the potential to contribute to national and regional research objectives. In LZ 2 the alluvial sequence is dominated by around 1 to 2m of late prehistoric/historic silty clay deposits that represent channel deposits of the Lea as it meandered across the site. The alluvial sequence is sealed by c 2 to 3m of made ground. In places the alluvial sequence has been entirely truncated. The zone has a moderate potential to contain palaeoenvironmental remains within the silts and clays that could be utilised to reconstruct river hydrology. These deposits have potential to address regional research objectives[24]. In LZ 3 undulations in the gravel topography suggest that the zone represents ecotonal channel marginal areas and deeper incised channels. The gravels are overlain by a peat and alluvial sequence that in places exceeds 2m in thickness. Deposits within this zone appear to have

[24] See Museum of London (2002) p79

suffered less truncation than those elsewhere on the site and therefore has the highest palaeoenvironmental potential.

3.6.7 Table 5 below summarises the potential to encounter remains of various periods.

Table 5: Archaeological potential of the site as identified by the geoarchaeological deposit model

Description	Environmental value	Potential within application site
Remains associated with prehistoric activity (temporary encampments, fish weirs, trackways)	Medium	Moderate
Remains associated with Romano-British activity (settlement activity)	Medium	Low
Remains associated with early medieval activity (settlement activity)	Medium	Low
Remains associated with Medieval activity (settlement activity)	Medium	Low
Remains associated with post-medieval activity (settlement activity)	Low	Low
Remains associated with modern activity (settlement activity)	Low	Low
Palaeo-environmental data	Medium	High

3.7 Map summary

3.7.1 The first Ordnance Survey mapping of 1868 to 1876 shows the site and its environs to be essentially still rural in character, although the first elements of industrialisation were present in the form of the Great Eastern Railway and the Tottenham and Edmonton gas works.

3.7.2 Industrialisation of the surrounding area continued well into the 20th century although the site remains undeveloped until the southward expansion of Deephams sewage works in the 1970's. This expansion consisted of sludge lagoons being constructed on the northern part of the site and the incinerator on the central part of the site. The sludge lagoons are replaced by buildings between 1999 and 2010.

3.7.3 Further details are provided in Table 13 at Appendix D.

4 Assessment

4.1 The Project

The principal development

4.1.1 The principal development comprises development of an ERF generating electricity using residual waste as a fuel and capable of an electrical output of around 70 MWe (gross). The principal development consists of the following development:

- tipping hall and one way access and exit ramps;
- a waste bunker with two overhead cranes and space to hold the equivalent of around seven days of processing capacity to provide sufficient space for mixing;
- two process lines (with each line having a capacity of 350ktpa), consisting of a moving grate, furnace, boiler and a flue gas treatment plant, stack and facilities for the recovery of incinerator bottom ash for recycling;
- a steam turbine for electricity generation;
- heat off-take equipment within the ERF capable of supplying heat through a connection to a separate district heating energy centre (DHEC). This separate DHEC is not part of the Project and will be developed by LB Enfield;
- air or water cooled condenser(s); and
- plant control and monitoring systems and offices.

Associated development

4.1.2 Associated development comprises the following elements:

- construction and operation of plant and structures to support the operation of the proposed ERF;
- installation of a green roof and a brown roof over parts of the proposed ERF;
- observation platform at roof level above the tipping hall;
- replacement waste water treatment facility;
- the decommissioning and demolition of the existing EfW facility and installation of temporary hard landscaping in this area;
- construction and operation of a Resource Recovery Facility;
- construction of EcoPark House accommodating a visitor and education centre with offices, and a base for the Edmonton Sea Cadets;
- construction of a boat canopy alongside the River Lee Navigation to service the requirements of the Edmonton Sea Cadets;
- utility works;
- construction of surface water pumps, pipework and water attenuation tanks;

- permanent hard and soft landscaping;
- site circulation and parking works;
- artificial lighting, site security and means of enclosure works;
- creation of a temporary Laydown Area:
- works to reinstate the current landscaping in the area used for the temporary Laydown Area; and
- site access and highways improvements.

4.1.3 The proposed new layout of the site is illustrated in Figure 5 in Appendix A.

4.2 Potential effects on archaeological and palaeoenvironmental remains

4.2.1 The potential construction impacts on buried remains could result from:

- demolition of existing structures and removal of slabs and foundations;
- excavations for slab formation (RRF and EcoPark House) and storage bunker (ERF); and
- piling for foundations.

4.2.2 The assessment of significance of impacts is provided in Table 6.

Table 6: Summary of probable effects

Effect	Magnitude of change	Asset affected	Environmental value	Significance of effect
Excavation of storage bunker	Minor	Arctic bed deposits	High	Slight or moderate
ERF slab construction	Minor	Modern made ground	Negligible	Neutral or slight
ERF piled foundations	Minor	Truncated floodplain deposits	Low	Neutral or slight
RRF/EcoPark House slab construction	Minor	Upper floodplain deposits	Medium	Slight
RRF/EcoPark House piled foundations	Negligible	Floodplain deposits	Medium	Neutral or slight

4.2.3 In LZ 1 clearance of obstructions and formation of new slabs would be unlikely to penetrate to a depth where buried alluvial deposits might be encountered however construction of the proposed storage bunker would require excavation sufficiently deep to encounter the palaeoenvironmental material (‘arctic beds’) within the underlying gravels and therefore the significance of effect is considered to be slight to moderate. In LZ 2

clearance of obstructions and formation of new slabs and foundations for the RRF and EcoPark House would impact on the upper floodplain sequence (overbank flood deposits) but the significance of effect would be slight.

4.2.4 Piling for foundations would produce a localised impact in areas where buried remains might be present; however the magnitude of impact from such localised impacts would be negligible to minor and the resultant effect would be neutral or slight.

4.2.5 The landscaping and hardstanding on the majority of the central and southern parts of the site is not likely to penetrate to a depth sufficient to have more than a minor impact on modern made ground.

4.2.6 It is assessed that although floodplain deposits with the potential to preserve remains of archaeological and palaeoenvironmental value are present on the Application Site it is unlikely that the construction of the ERF and its associated structures would have a significant effect on these deposits. Less than significant effects may however result from the construction of certain elements of the Project.

4.2.7 Remains likely to be subject to these effects would be confined to:

- Potential Arctic Bed palaeoenvironmental deposits within the footprint of the propose ERF storage bunker;
- Upper floodplain alluvial deposits within the footprint of the proposed RRF and EcoPark House; and
- Alluvial floodplain deposits within the footprint of the piling grid.

4.2.8 Notwithstanding the less than significant effects on these deposits it is recommended that a programme of archaeological investigation be carried out to ensure that the heritage value from the deposits affected is appropriately recorded. The programme of investigation should be developed in conjunction with GLAAS and could comprise some or all of the following:

- targeted geo-archaeological boreholes on selected proposed pile locations;
- watching brief during excavations for storage bunker; and
- watching brief during site preparation for construction of RRF and EcoPark House.

4.3 Possible setting impacts of development

4.3.1 The Project does not present a substantial change to the current use of the site and it is therefore not considered that more than a negligible change would occur in the setting of the Chingford Mill Pumping Station listed buildings.

4.3.2 Temporary setting effects may result from the use of the adjacent Laydown Area during construction. The Laydown Area would be used for

material storage and temporary office accommodation. Access to the Laydown Area would be via the Lee Park Way.

4.3.3 The temporary use of the Laydown Area, which is currently used for aggregate storage, does not represent a substantial change to the setting of the Pumping Station. Effects from additional traffic movements would be minimised by adopting the proposed new access via Lee Park Way. The overall significance of temporary setting impacts from the Project is therefore judged to be neutral.

5 References and Bibliography

AMEC (2014) *North London Waste Authority, Geotechnical Ground Investigation, Draft Factual Ground Investigation Geotechnical Report*

T F T Baker, R B Pugh (Editors), (1976) *A History of the County of Middlesex: Volume 5: Hendon, Kingsbury, Great Stanmore, Little Stanmore, Edmonton Enfield, Monken Hadley, South Mimms, Tottenham,* Victoria County History

Department for Communities and Local Government (2012) *National Planning Policy Framework*

English Heritage (2011) The Setting of Heritage Assets

Ground Technology Services (2012) Phase 2- Edmonton Ecopark Site Investigation

Institute for Archaeologists, rev. (2012) Standards and Guidance for historic environment desk-based assessment

Institute for Archaeologists, rev. (2013) By-Laws, Standards and Policy Statements of the Institute for Archaeologists, By-laws for code of conduct

May Gurney (2011) London Waste Ecopark, Edmonton Site investigation

Museum of London (2002) A research framework for London archaeology

Pevsner, Nikolaus; Bridget Cherry (1998). *The Buildings of England, London 4:* North*.* Yale

Weinreb, B, Hibbert, C, Keay J and Keay J (2008) *The London Encyclopaedia*, Macmillan, London

Electronic sources

English Heritage - Historical Periods

http://www.pastscape.org.uk/TextPage.aspx (accessed 31.07.14)

Geology of Britain viewer

http://mapapps.bgs.ac.uk/geologyofbritain/home.html (accessed 31.07.14)

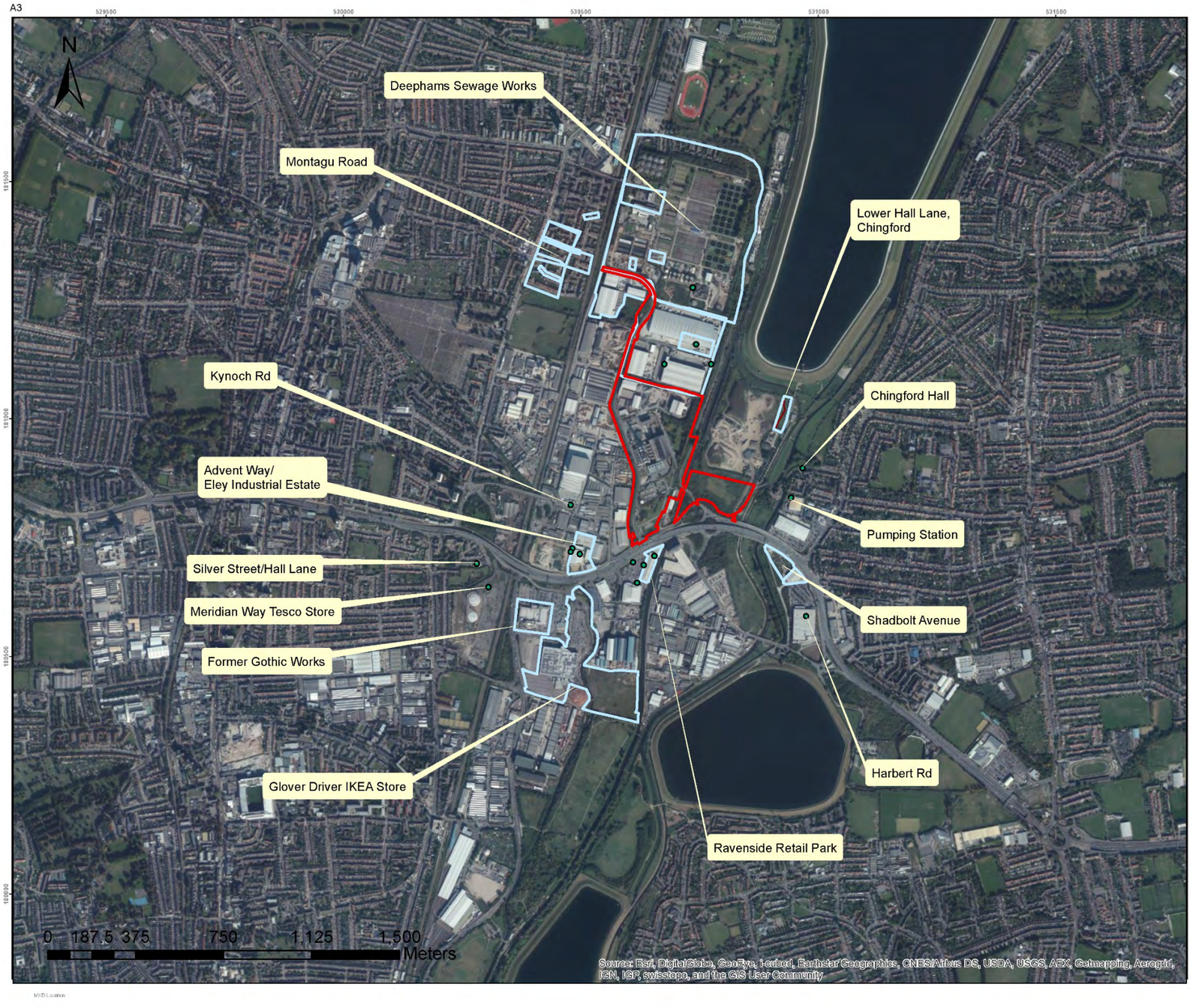
The Domesday Book Online – Glossary

http://www.domesdaybook.co.uk/glossary.html#h (accessed 31.07.14)

Appendix A

Figures

A3



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- Archaeological activity_point
- Application Site Boundary
- Archaeological Activity _ line
- Archaeological Activity _polygon

17/09/2014 13:54:41

Revision	Date	By	Chkd	Appd
F1	07-05-2015	DML	DML	DML

ARUP

Client
NLWA

Job Title
North London Heat and Power Project

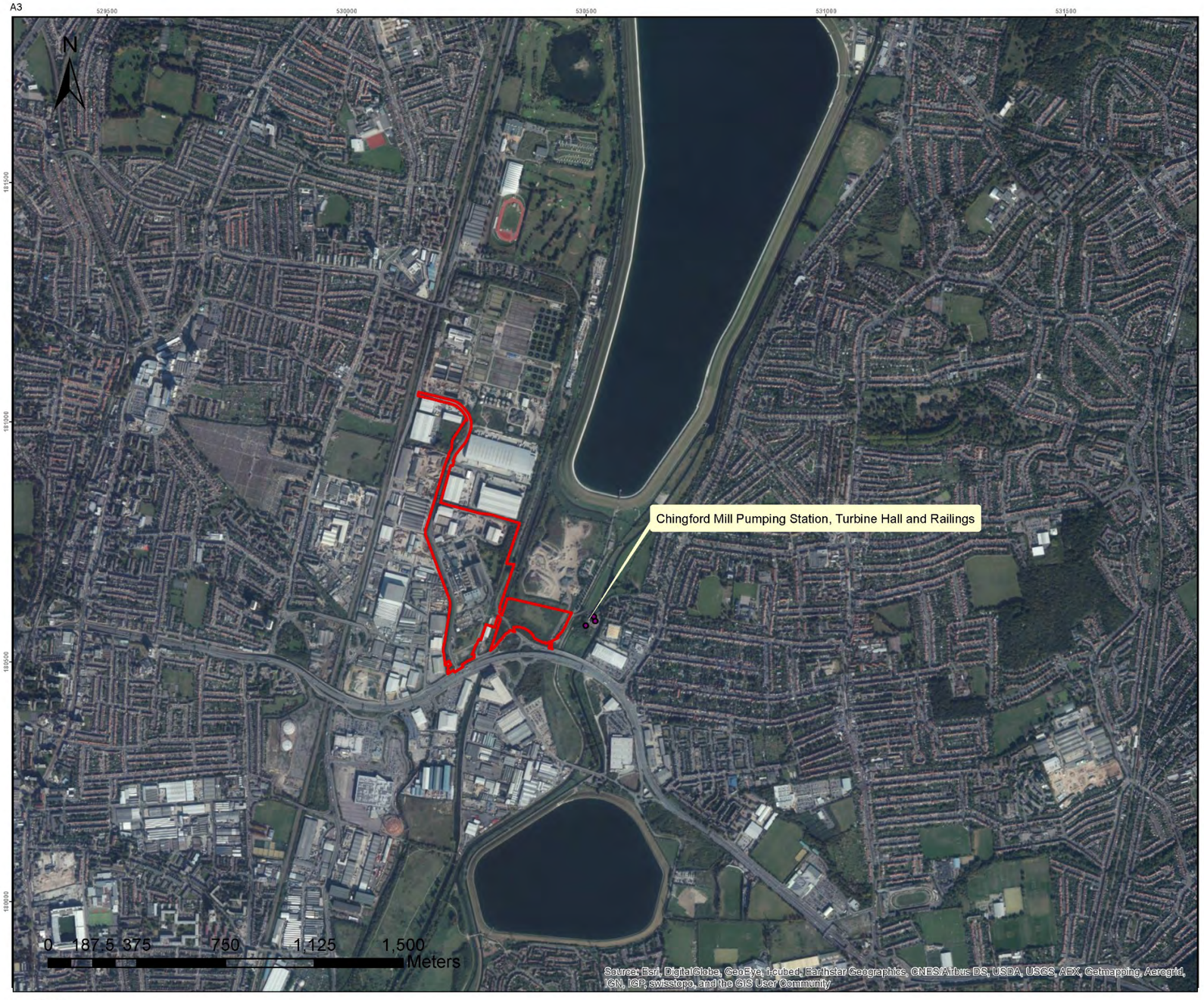
Drawing Title
Figure 1 - Application Site and Archaeological Activity in Assessment Area

Scale at A3

Job No	Drawing Status	Revision
235271-15	Final	F1

Drawing No
001

A3



Legend

- Listed Buildings
- Application Site Boundary

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Revision	Date	By	Chkd	Appd
F1	07-05-2015	DML	DML	DML

ARUP

Client
NLWA

Job Title
North London Heat and Power Project

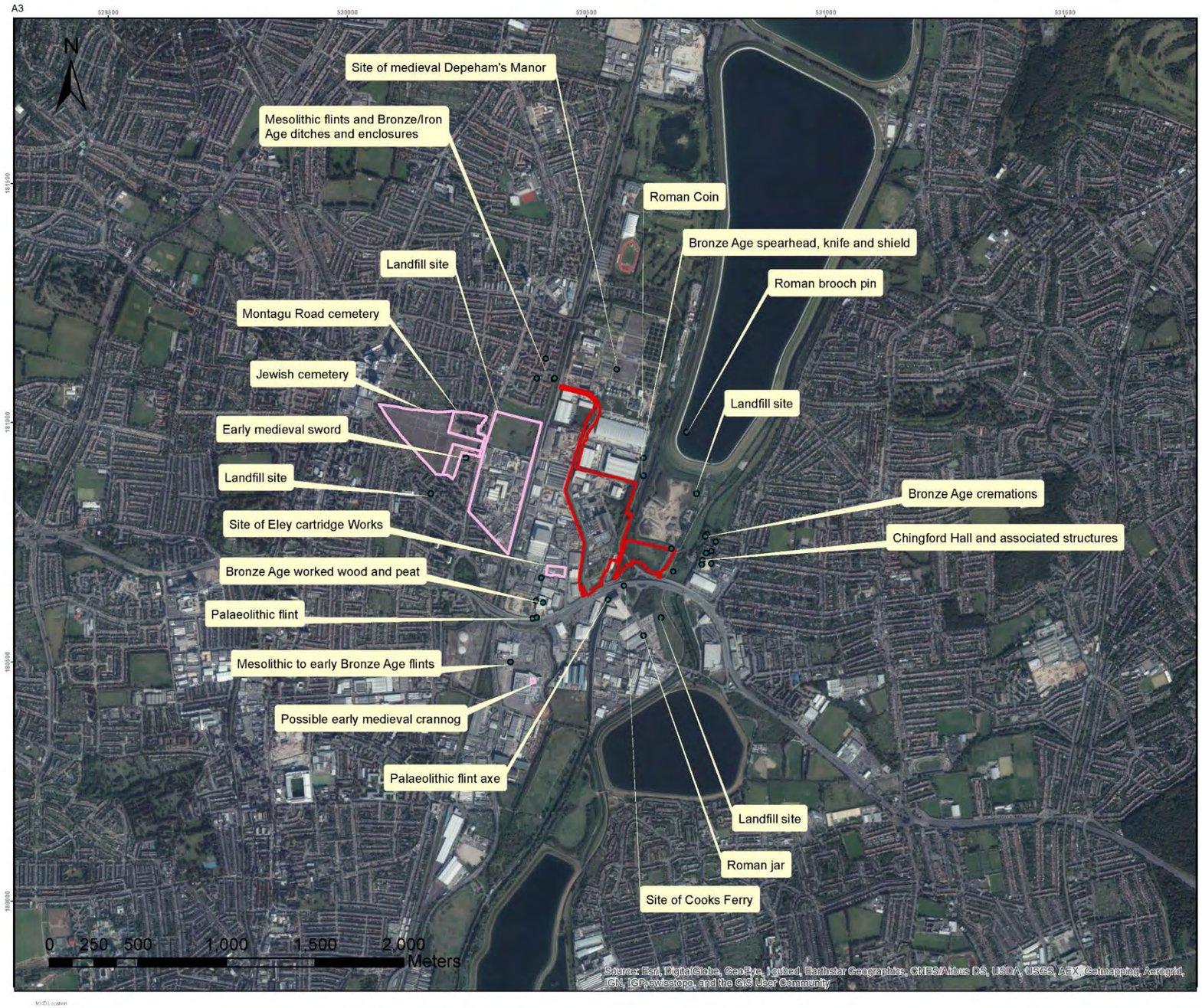
Drawing Title
Figure 2 Designated Heritage Assets (Listed Buildings)

Scale at A3

Job No	Drawing Status	Revision
235271-15	Final	F1

Drawing No
002

A3



Legend

- Non-designated Assets_point
- Application Site Boundary
- Non-designated assets_poly

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Revision	Date	By	Chkd	Appd
F1	07-05-2015	DML	DML	DML

ARUP

Client
NLWA

Job Title
North London Heat and Power Project

Drawing Title
Figure 3 Findspots

Scale at A3

Job No	Drawing Status
235271-15	Final

Drawing No	Revision
003	F1

Figure 4: Borehole location plan

Figure 5: Project site layout

1. **Northern area accommodating the new Energy Recovery Facility (ERF)**

2. **Southern area accommodating the Resource Recovery Facility (RRF) and the Sea Cadets centre, reception building and visitor centre (‘EcoPark House’)**

3. **A central space where the existing Energy from Waste facility is located that would be cleared.**

4. **New extensive landscape area along the edge with Lee Valley Regional Park**

Appendix B

Archaeological data

B1 Previous archaeological investigations

Table 7: Archaeological activity within the assessment area

Year	Archaeological Activity	Location	Description
992	Watching Brief	Former Gothic Works, Angel Road/ Meridian Walk/ Glover Drive, Enfield, N18	Undertaken at the former Gothic Works between May and June 1992 by the Museum of London Archaeology Service. No archaeological features were recorded but a number of prehistoric flints were present in the alluvial deposits encountered.
1996	Borehole Survey	Ravenside Retail Park, Argon Road, Enfield, N18	A borehole survey was undertaken at the Ravenside Retail Park, Argon Road, Enfield, by Quest Technical Services in 1996. The sequence in borehole 1 was as follows: London Clay was recorded at a height of around 3.4 m OD, above which was 2.5 m of gravel. The gravel was overlain by a 0.6 m thick layer of peat at around 7.4 m OD, which was sealed by a 0.7 m deposit of alluvial clay. The of the clay lay at around 8.1 m OD and a 2.2 m thick layer of made ground sealing these deposits. A similar sequence was observed in the other boreholes examined.
1999	Evaluation and Excavation	Land opposite Nos. 403-435 Montagu Road, Edmonton, Enfield	Natural brick-earth was cut by a series of palaeochannels and probable tree throw hollows (resulting from tree clearance), some of which contained evidence of flint working. A series of linear features truncated the tree throws and, in the centre of one, a single post- or stake-hole was located. One tree throw, recorded in a ditch or gully, is provisionally the only evidence for regeneration of woodland. Filling all the features covering the brickearth were successive layers of alluvial clay, which represents periodic flooding of the area, resulting in the final silting up of all the later palaeochannels. In the SW corner of the site these were cut by numerous small rivulets. The site was then sealed by post-medieval ploughsoil, cut by a few modern services, allotment features and by the construction of a building.

Year	Archaeological Activity	Location	Description
2000	Evaluation and Excavation	Land Opposite Nos 307-357 Montagu Road, Lower Edmonton, Enfield	
2000	Evaluation and Excavation	Land Opposite Nos 359-403 Montagu Road, Lower Edmonton, Enfield, Evaluation	
2000	Evaluation	London Rubber Company site, Harbert Rd, Chingford	Wessex Archaeology. Eleven trenches were excavated, 2m x 15m. No archaeological features, deposits or artefacts were encountered. Modern disturbance layers up to 1.44m thick overlaid alluvial clays, which in turn overlaid the natural gravels 7.90-9.52m OD. Six palaeochannels were recorded cutting the gravels.
2001	Archaeological Evaluation	Deephams Sewage Treatment Works, Adra Road, Edmonton, Enfield	No archaeological remains were recorded in this preliminary phase of evaluation. The evaluation has indicated the presence of deposits with high palaeoenvironmental potential in the form of peat deposits and waterlogged organic remains.
2004	Watching Brief	Kynoch Rd/ Nobel Rd	
2004	Evaluation	Meridian Way Tesco Store	Evaluation by AOC. 6 trial trenches were excavated ahead of development. 2 were abandoned due to health and safety issues, and 4 were fully investigated. They all showed evidence of modern made ground through to alluvial clay. Severe truncation meant no archaeological features were recorded.

Year	Archaeological Activity	Location	Description
2004 - 2005	Evaluation and Excavation	The IKEA superstore, Glover Drive, Edmonton, Enfield	An archaeological excavation consisting of three linked trenches was carried out at Glover Drive, Edmonton, by AOC Archaeology Group during April and May 2004. The excavations revealed sequences of waterborne materials including gravel, peat and tufa layers from palaeo-channels. A possible early medieval crannog-like structure constructed from timbers was found preserved within alluvial deposits. Archaeological deposits were found as little as 1.0m below the existing modern ground surfaces.
2005	Watching brief	Former Deephams Sewage Treatment Works, Ardra Road, Edmonton	No significant archaeological features or finds were discovered.
2006	Desk Based Assessment	Land off Advent Way, Edmonton, Enfield	This work suggested that there may be the presence of a possible ridge between North-South-running water channels of the proto-River Lea within the brownfield site earmarked for re-development. Alluvial deposits suggesting riverine deposition episodes were found during previous investigations of the development area and adjacent ground.
2006	Evaluation and Excavation	Land off Advent Way, Edmonton	Three trenches were excavated by L-P: Archaeology in this area to establish the presence, if any, of any palaeochannels or islands that had been suggested to exist by a previous desk based assessment of the area by Pre-Construct Archaeology.
2006	Desk Based Assessment	Ravenside Retail Park, Argon Road, Enfield, N18	Archaeological desk based assessment carried out by the Museum of London Archaeology Service in advance of proposed re-development; the area covered is located within an archaeological priority area with significant potential for archaeological and palaeoenvironmental evidence from the prehistoric period onwards. If such remains are present, as thought likely to occur, these are likely to include reclamation and revetment work along the adjacent river, as well as the palaeoenvironmental sequence of the area.

Year	Archaeological Activity	Location	Description
2007	Geoarchaeological analysis	Advent Way, Enfield	Sediment and pollen analyses were undertaken by the Museum of London Archaeology Service of materials recovered in an April 2006 evaluation by L-P Archaeology. The samples, also radiocarbon dated, indicate deposition and preservation in and by freshwater riverine waterlogging. The samples observed and analysed include some Bronze Age peat layers which are somewhat later than the norm for other previously examined areas of the River Lea valley. The palaeochannels from which these samples were obtained are from a predecessor of the current River Lea.
2007	Watching Brief	Land at Shadbolt Avenue, Chingford, Waltham Forest	During geotechnical investigations thirteen test pits were monitored in order to ensure that any features, artefacts or ecofacts of archaeological interest were recorded. Additionally a further six test pits, to establish the extent of hydrocarbon contamination, were monitored. No archaeological finds or features were encountered
2007	Watching Brief	Shadbolt Avenue, Chingford, Waltham Forest	A watching brief was conducted in 2007 by Archaeology South East on Land at Shadbolt Avenue. Site code SDB07. During geotechnical investigations a selection of trial pits were monitored in order to ensure that any features, artefacts or ecofacts of archaeological interest were recorded. Additionally, two trenches were excavated in the attempt to locate a culvert running across the site, which was sited in the northern edge of the site. No archaeological finds or features were encountered during the course of the trial pitting or the excavation of the trenches. A large area of the site showed signs of disturbance from groundwork associated with creation of the nearby industrial shopping depots. Layers of made ground were encountered overlying the underlying geology of mid orange loose gravels with localised patches of alluvial clay.

Year	Archaeological Activity	Location	Description
2010	Watching Brief	Deephams Sewage Works Pickett's Lock Lane/Meridian Way/Ardra Road, Edmonton, Enfield: Watching Brief	A watching brief was carried out between the 10th-18th May 2010 by Oxford Archaeology at Deephams Sewage Works. The watching brief was focused on an area where new sewage tanks were to be located. This phase of investigations revealed evidence of high levels of truncation to the west of the site, due to only a few archaeological features being present. The most significant features were medieval field boundaries and a fenced enclosure, possibly associated with Deephams Manor Farm. 19th century bottle dumps were also identified/
2010	Geoarchaeological Deposit Model	Deephams Sewage Works Pickett's Lock Way/Meridian Way/Ardra Road, Edmonton, Enfield	In August 2010 Oxford Archaeology updated the geoarchaeological deposit model for Deephams Sewage Works at Edmonton. The model was created using information from a survey of 112 boreholes and test pits. The model shows that a considerable depth of the Holocene alluvium survives to the southeast of the site. The terrace gravels rise up to the west with a shallow covering of alluvium and brickearth.
2010	Watching Brief	Deephams Sewage Works,Pickett's Lock Lane/Meridian Way/Ardra Road, Edmonton, Enfield: Watching Brief	Oxford Archaeology maintained a watching brief in May 2010 on geotechnical boreholes at the Deephams Sewage Works. Five of the eight borehole locations were monitored, no evidence of archaeological activity was recorded although peat deposits of a possible Neolithic to Bronze Age date were located.
2010 - 2011	Watching Brief	Deephams Sewage Works Meridian Way/Ardra Road, Edmonton, Enfield	A watching brief was carried out at Deephams Sewage Works between the 17th December 2010 and the 10th January 2011 by AOC Archaeology. The work comprised the recording of a 10 x 10m area. The site revealed post medieval to modern deposits including ploughsoils and a boundary ditch, the latter of which is thought to be associated with Deephams Manor Farm.

Year	Archaeological Activity	Location	Description
2011	Watching Brief	Lower Edmonton Area [DMAWoodford 70], Enfield Lower Edmonton Area, Woodford	A watching brief was carried out in DMA Woodford 70, Lower Edmonton Area, Enfield by Compass Archaeology in 2010 and 2011. Approximately 283m of trenching were observed during Thames Water mains replacement works along Pentland Close, Nile Drive and Congo Drive. After initial monitoring it was agreed with English Heritage that no further monitoring was required during works in the area. Only modern road layers and made ground deposits relating to the 1999 residential redevelopment of the site were observed. No significant archaeological finds or features were recorded. *Natural deposits were not encountered. Excavations did not extend beyond the woven plastic mesh layer at about 1.1m below ground level.*
2012	Cultural Heritage Assessment	Lower Hall Lane, Chingford, Waltham Forest: Cultural Heritage Assessment	A desk based assessment was undertaken in November 2012 by URS at the Lower Hall Pumping Station, Chingford.
2014	Geoarchaeological Survey	Lower Hall Pumping Station, Hall Lane, Chingford, Enfield: Geoarchaeological Survey	A borehole survey was undertaken at Lower Hall Pumping Station by Archaeology South East between the 3rd to 4th February 2014. The site comprised a transect of 10 boreholes. The boreholes revealed soils, none of which were thought to have palaeo-environmental potential. *Natural gravel was observed at 8.67m OD*

B2 Known heritage assets

B2.1 Heritage assets within the footprint of the scheme

Table 8: Non-designated heritage assets within the footprint of the scheme

HER site number	Name	Period	Description	Significance of asset
NONE				

B2.2 Heritage assets within 1km of the site

Table 9: Designated heritage assets within 1km of the site

NHLE[25] site number	Name	Designation	Period	Description	Significance of asset
1250896	Chingford Mill Pumping Station	Grade II listed building	Post-medieval	Dated 1895. Built for the East London Waterworks Co. Brick in flemish bond with soft red brick and terracotta dressing, same box framing. Roofs of tile with swept eaves and exposed rafter ends. The plan is derived from a typical parish church plan; at the centre a tower of three stages with round-arched openings.	Medium

[25] The National Heritage List for England (http://list.english-heritage.org.uk/advancedsearch.aspx)

NHLE[25] site number	Name	Designation	Period	Description	Significance of asset
1065574	Water Turbine House, Chingford Mill Pumping Station	Grade II listed building	Post-medieval	Built in 1891 to house two turbine engines which were placed side by side. Plinth of brick in flemish bond, with brick and concrete to sluice; box framing above with painted render infill panels; decorative framing to gable ends. Roof of tile with swept eaves and exposed rafter ends. Low utility shed facing pumping station is of late 20th century date and specifically excluded. Forms a group with the Pumping Station to the southwest.	Medium
1065575	Metal Railing to Chingford Mill Pumping Station	Grade II listed building	Post-medieval	1890-95. Project engineer of East London Water Works Company, William Booth Bryant. Metal with concrete plinth. Shallow curving plan in twelve sections; alternate upright supported by curved brackets. Forms a Group with the Chingford Mill Pumping Station, Lower Hall Lane.	Medium

Table 10: Non-designated heritage assets within 1km of the site

HER site number	Name	Period	Description
MLO75925	Deposit	Prehistoric	Deephams Sewage Treatment Works, evaluation found deposits with high palaeoenvironmental potential of peat deposits and waterlogged organic remains. Deposits varied from light grey and ornage clays, alluvial clays and ornage brown clays to mottled grey/brown clayey sand and dark blue clays. These normally sealed or lay above the thin layers of peat. Some deposits contained fragmentary pieces of peat.
MLO12165	Findspot - Flint	Palaeolithic	Located on Angel Road, Edmonton.
080592/00/00	Findspot - Ovate Implement	Palaeolithic	Abraded ovate implement found at Cooks Ferry.
MLO39785	Findspot - Animal Remains	Palaeolithic	Discovered at a site on Angel Road, Edmonton, Enfield.
080584/01/00	Findspot - Flake	Palaeolithic	Angel Road, Edmonton, implements said to have been found here roe includes one un-retouched flake.
MLO74	Flint Scatter	Mesolithic	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, September - October 1999; site code MGU99. Struck flints recovered.
084536/00/00	Peat	Mesolithic to Neolithic	Watching brief on a sewer pipeline undertaken by Vaughan & Murray found a slight organic horizon 1.8m below the current surface at Eley Industrial Estate N18.
082595/00/00	Findspot - Flint Implements	Mesolithic to Bronze Age	Watching brief by Museum of London Archaeology Service 1992 at Gothic Works, found alluvial gravel overlain by natural brick-earth containing flint implements.
084877/00/000	Wood	Neolithic to Bronze Age	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, 1999; site code MGU99. Numerous irregular amorphous hollow interpreted as tree throws suggested large scale tree and shrub clearance in the Neolithic to early bronze age periods.

HER site number	Name	Period	Description
084878/00/000	Ditch	Neolithic to Bronze Age	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, 1999; site code MGU99. A NW-SE ditch was recorded; ran parallel to a palaeochannel (SMR ref. 084879).
084879/00/000	River, Water Channel	Neolithic to Bronze Age	Former Nursery Site and Meadowville Day Centre,, evaluation and excavation undertaken by Derek Roberts for PCA, 1999; site code MGU99. Large NWSE palaeochannel - which would have been a dominant feature in the Neolithic and Bronze Age landscape - was recorded.
MLO75949	Ditch, Pit, Post Hole, Gully	Neolithic to Bronze Age	Earliest remains at Plevna Road consisted of tree clearance from the Neolithic or early Bronze Age and ditches and pits of the same date. Numerous flint tools and waste flakes were recovered as well, indicating in situ working and well as large quantities of burnt flint, particularly from four features. This was followed by further limited tree clearance and the establishment of an extensive field system of late Bronze Age date over the site.
082596/00/00	Marsh, Marsh, Peat, Peat	Neolithic to Post-medieval	Watching brief by Museum of London Archaeology Service 1992 at Gothic Works, found alluvial gravel were overlain by natural brick-earth containing Mesolithic-early Bronze-Age flint implements. Above lay waterlain silty clay which became peaty towards its surface, suggesting area was under water or part of a marsh (the site lies in the valley of the River Lea) until the Post-medieval period.
084880/00/000	Field System, Ditch	Bronze Age	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, 1999; site code MGU99. Two parallel ditches dated to the middle bronze age were recorded. They were E-W aligned, spaced approximately 20m apart and may have represented field systems. Evidence for re-cutting of the northern-most ditch element suggests an extended period of use for the system.

HER site number	Name	Period	Description
084881/00/000	Pasture	Bronze Age	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, 1999; site code MGU99. Evidence of repeated overbank flooding of the palaeochannel (SMR ref. 084879) suggests that the land may have been used as seasonal pasture. Alluvial silting, puddling and small rivulets attest to increased flooding of the area, apparently in the later bronze age.
MLO98471	Palaeo-channel	Bronze Age	Advent Way, series of palaeochannels, with infilling peat and silts, and waterlogged wood fragment recovered from excavations carried out 2006. A series of channel courses were identified, with soil facies analyses suggesting waterborne deposition of sediments in a low energy environment. Two of the three pieces have been sharpened. All the samples were Alder and a Bronze Age date has been obtained from one piece. The evidence is consistent with an Earlier Prehistoric stream complex as part of the Lea Valley River.
081616/00/00	Findspot - Spearhead	Bronze Age	Basal-Looped Spearhead 'Edmonton Marsh' found in 1869.
080586/00/00	Findspot - Shield	Bronze Age	Shield 67cm diameter, 10 concentric rings beside the turned up edge, central boss 13cm diameter, handle intact found in Edmonton.
081617/00/00	Findspot - Knife	Bronze Age	Socketed knife 'Edmonton Marsh' 1869.
MLO2408	Cemetery	Bronze Age to Iron Age	Lower Hall La Chingford E4, excavations by Macgowan for the Passmore Edwards Museum revealed two cremations dateable by pottery.
MLO258	Findspot - Pottery	Romano-British	Unspecified works to the River Lea at Chingford c.1852 revealed a "Romano-British vessel.
MLO2735	Findspot - Coin	Romano-British	Coin of Victorianus found 1968 Lea Navigation Canal (west bank of)
MLO579	Findspot - Pin, Coin	Romano-British	Gold pin of a crossbow brooch found 1968 in gravel on the west bank of the canal halfway between Picketts Lock & Angel Rd Bridges. Also found roman coin, Lea Navigation Canal.

HER site number	Name	Period	Description
MLO98026	Worked Timber, Crannog, Building Platform	Romano British to early medieval	Late Romano British or early medieval timber platform, identified as a possible crannog, and two round-wood stake-built structures, were found through excavation at the Glover Drive IKEA site, Edmonton, by AOC Archaeology Group during 2004. Structures were preserved within alluvial silts in the valley of the River Lea.
080672/00/00	Findspot - Sword	Early medieval	Viking sword found c.1911 in bed of an old meander of the River Lea, Edmonton, guard & pommel were inlaid with a chequered design in brass.
MLO14196	Manor House	Early medieval to medieval	Lower Hall Lane, Chingford, E4, documentary sources reveal it was held by the Dean and Chapter of St Pauls between 998 & 1066. It was one of the manors which supported the canons household and leased out to local farmers; was repossessed by Henry VIII in 1544 and sold or passed on until purchased by Essex County Council in 1949.
MLO13292	Settlement	Early medieval to medieval	Lower Hall Lane, Chingford, E4, documentary evidence suggests area was the site of early medieval settlement of "Cingefort" in 913; is recorded in the Domesday Book as Cinghefortreaney translates "Chagingeford" as "the ford of dwellers by the stumps" probably referring to the various pile dwellings known to have existed in the area.
MLO14181	Manor House, Moated Site	Medieval	Lower Hall Lane, Chingford, E4 (Site of Manor of Chingford St Paul's), documentary evidence dated c 1480 revealed it consisted of a hall with two storeys, buttery, parlour and chamber. Excavations by MacGowan for the Passmore Edwards Museum revealed part of the moat but failed to locate the site of the house.

HER site number	Name	Period	Description
061114/01/00	Moat	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated c 1480 attests the moat surrounded the hall, kitchen, granary and 2 stables of the manor of Chingford St Pauls; no evidence moat was present in the lease of 1265 but still visible before WWII. Excavations by MacGowan for the Passmore Edwards Museum revealed the moat had varied in width (between 4 & 10m), was not completely circular but "had a causeway to the island".
061113/07/00	Poultry House	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 reveals a henhouse within the inner gate.
061113/08/00	Service Wing	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 reveals the existence of servants quarters outside the inner gate of the manor of Chingford St Pauls.
061113/13/00	Pigsty	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 reveals pig stye or "piggery" of the manor of Chingford St Pauls was located outside the outer gate.
061114/02/00	Kitchen, Outbuildin g, Oven	Medieval	Lower Hall Lane, Chingford, E4, documentary sources dated c 1480 reveal late medieval manor of Chingford St Pauls possessed a kitchen containing a bread oven, a "small low building" was attached to the north of the kitchen with a larder attached to the south.
061114/06/00	Stable	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated c 1480 reveals manor of Chingford St Pauls possessed a stable "for the tenant" at the outer gate.
061113/01/00	Chapel	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed chapel of Chingford St Pauls was located within the inner courtyard gate and near the hall which was linked by a passage; chapel was roofed with tiles and contained a portable altar and a small cross.

HER site number	Name	Period	Description
061113/04/00	Granary	Medieval	Lower Hall Lane, Chingford, E4, documentary sources dated 1265 reveal a granary and grinding house within inner gate of the manor of Chingford St Pauls; was roofed with oak tiles; other granaries were recorded outside the inner gate but within earthwork enclosures and perimeter fences.
061114/07/00	Barn	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated c 1480 reveals manor of Chingford St Pauls possessed 2 barns located at the outer gate; one of the barns was tiled, the other with straw thatch.
061114/03/00	Granary	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated c 1480 reveals manor of Chingford St Pauls possessed a granary roofed with tile.
061114/04/00	Dairy	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1480 revealed manor of Chingford St Pauls possessed a dairy with a straw thatched roof located outside the moat.
061113/05/00	Dairy	Medieval	Lower Hall Lane, Chingford, E4, documentary sources dated 1265 reveal dairy of the manor of Chingford St Pauls to be within the inner gate; housed within a "divided building".
061113/02/00	Bakehouse	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 reveals detached bake-house stood next to the kitchen of Chingford St Pauls within the inner courtyard gate.
061113/10/00	Malt Kiln, Brewhouse	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed manor of Chingford St Pauls possessed a brew house containing a malt kiln; located outside the inner gate, north of the stables.
061114/08/00	Gate	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated c 1480 reveal various sections of the manor of Chingford St Pauls were separated into discreet areas by the moat and by an outer gate.

HER site number	Name	Period	Description
061113/11/00	Barn	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed manor of Chingford St Pauls possessed 2 barns located outside the inner gate, enclosed by ditches and fences; one barn being used for wheat and the other for oats.
061113/12/00	Cow House	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed manor of Chingford St Pauls possessed 2 cattle-sheds, one for cows the other for oxen, located outside the middle gate; by 1265 they were "old and decayed".
061114/05/00	Cow House	Medieval	Lower Hall Lane, Chingford, E4, documentary sourced dated c 1480 reveal manor of Chingford St Pauls possessed a cattle shed thatched with straw, outside the moat.
061113/03/00	Kitchen	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed "good kitchen with a well tiled roof" within the inner courtyard of the manor of Chingford St Pauls, next to the bake-house and possessed a furnace, 2 ovens and 2 tables.
061113/09/00	Stable	Medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1265 revealed manor of Chingford St Paul possessed a divided stable outside the inner gate.
061114/09/00	Hearth	Medieval	Lower Hall Lane, Chingford, E4, excavations by Macgowan for the Passmore Edwards Museum 1989 revealed 2 "pitched tile hearths" tiles, laid on edge (if pitched) & set in clay, indicated a long period of usage. Environmental evidence produced large quantities of burnt grain. Pottery finds date the hearths to the 14th century. It is suggested the main house was located to the south.
MLO76765	Cut	Medieval	Plevna Road, medieval evidence very limited with only a single shallow cut being recorded; suggests site was still used for agricultural purposes in this time.

HER site number	Name	Period	Description
080703/00/00	Manor House, Moated Site	Medieval to post-medieval	Picketts Lock Sewage Works, manor named after Roger De Depeham who made various purchases in reign of Edward III.
061109/00/00	Ferry Crossing	Medieval to post-medieval	North Circular Rd Chingford E4, documentary evidence reveals cooks ferry existed by 1629 and regarded as the "most convenient way into London". Redundant by 1675 when the River Lea was bridged.
MLO19165	Manor House	Medieval to post-medieval	Lower Hall Lane, Chingford, E4, documentary evidence dated 1588 manorial seat had moved from Chingford Earl to Friday Hill House.
084401/00/00	Landfill Site	Post-medieval	Parr Clo (Provident Park), not known whether this site was made or worked land, and the date of infill is unknown, although all of are 19th/20th century date.
062787/00/00	Landfill Site	Post-medieval	Lee Park Way Chingford South Pumping Station, not known if site was made or worked land, and date of infill unknown, although all of 19th/20th century date.
062788/00/00	Landfill Site	Post-medieval	Harbet Rd, not known if site was made or worked land, and the date of infill is unknown, although all of 19th/20th century date.
061110/00/00	Bridge	Post-medieval	North Circular Rd, Chingford E4, documentary evidence reveals River Lea was bridged at Cooks Ferry between 1629 & 1675, repaired c 1720 at expense of the tenant of Chingford Hall. Taken over by Essex CC in 1878, now forms part of the North Circular Road.
061115/00/00	Manor House	Post-medieval	Lower Hall La Chingford E4, documentary & pictoral evidence shows the manor house of Chingford St Pauls as a 2 storey building, timber framed and plastered, probably dating from the late 16th century.
084882/00/000	Cultivation Soil	Post-medieval	Former Nursery Site and Meadowville Day Centre, evaluation and excavation undertaken by Derek Roberts for PCA, September - 1999; site code MGU99. Post-medieval plough-soil covered the site.

HER site number	Name	Period	Description
MLO76766	Boundary Ditch, Fence, Quarry Pit	Post-medieval	Plevna Road, post-medieval development of site included large re-cut ditch recorded at far west, cut by a second larger ditch and then cut twice again. Suggests formed back boundary of the post-medieval settlement of Edmonton. Presence of mineral extraction to the east of these ditches would suggest that this was the case. Four post holes in rough alignment indicate the movement of the boundary.
MLO103946	Jewish Cemetery, Cemetery Lodge, Ohel	Post-medieval to 21st century	Edmonton Federation Cemetery, Montagu Road, Edmonton, cemetery founded 1889 by the Federation of Synagogues on land donated by Samuel Montagu. Is the largest of the three cemeteries on Montagu Road and has abundant fine headstones. Site contains a lodge, a small information centre and a prayer building.
MLO69019	Jewish Cemetery, Cemetery Lodge	Post-medieval to 21st century	Western Synagogue, Montagu Road, Edmonton, cemetery was founded 19th century, possible date 1884 or 1889. Contains no buildings other than a small entrance lodge and is adjacent to the larger Edmonton Federation Cemetery.
MLO72531	Landfill Site	19th Century to 21st century	Landfill site at Monyagu Road, Edmonton was in use from 1896 to 1958.
MLO105269	Munitions Factory	20th century	Eley Cartridge Factory, Eley Road, Enfield, was a single storey brick building on the corner of Nobel Road and Eley Road. During WWI it produced 209 million .303 cartridges.
MLO69066	Cemetery, Cemetery Chapel	20th to 21st century	Tottenham Park Cemetery, Montagu Road, Lower Edmonton, opened in 1912; private cemetery now predominantly used for Muslim burials. It contains a derelict Gothic chapel.
MLO75462	Water Channel	Unknown date	London Rubber Company site, Harbert road, Chingford, six palaeochannels recorded cutting into the natural gravels and filled or sealed by alluvium, possibly former water courses associated with River Lea and Ching.

Appendix C

Project archive

Project archive catalogue

Table 11: Project archive catalogue

File Number	Description of contents
235271-01	HER data
235271-02	Historic Map data
235271-03	GIS output

Appendix D

Cartographic data

D1 Cartographic sources

Table 12: Cartographic sources

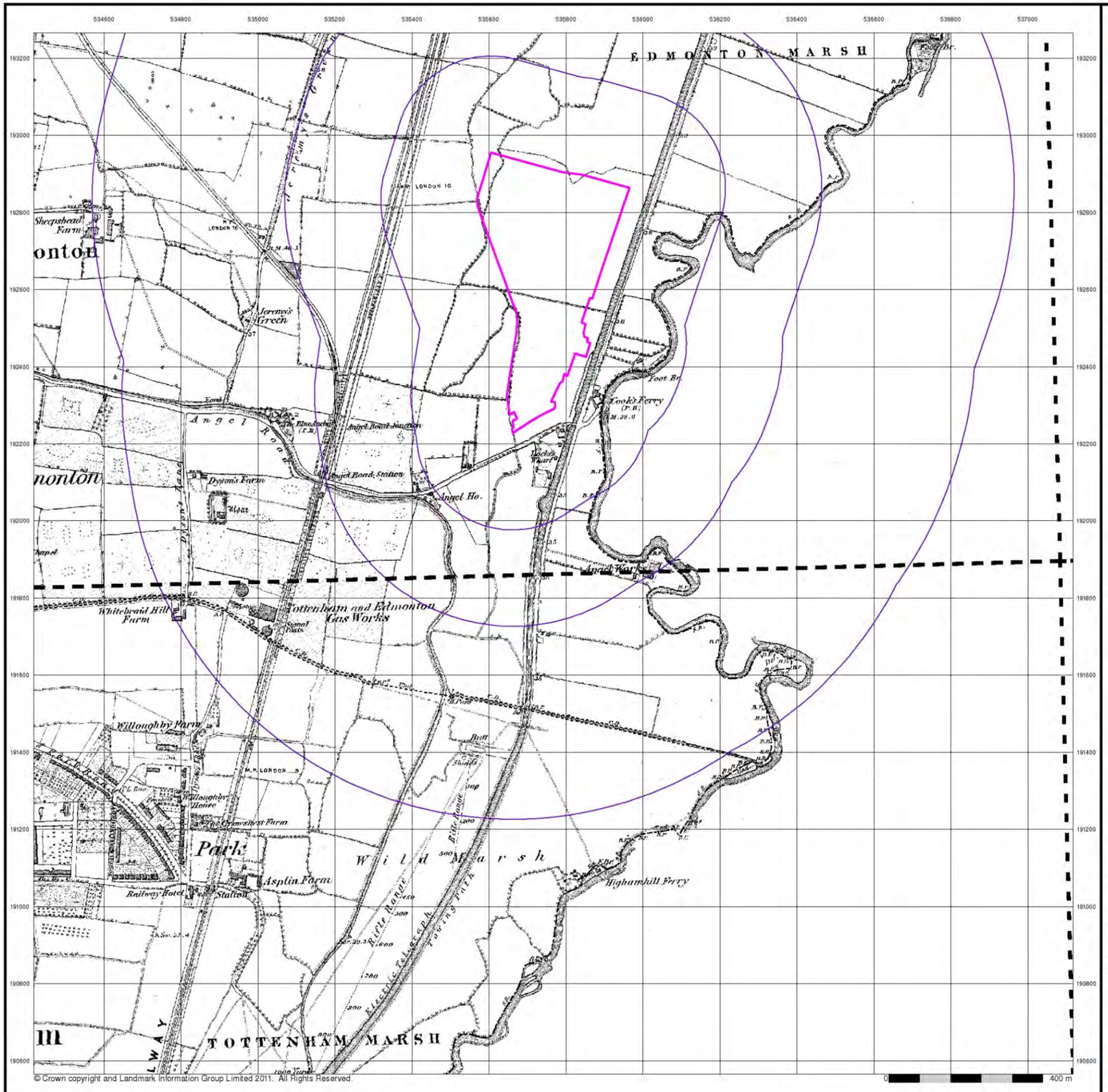
Source	Scale	Date
Middlesex	1:10560	1868-1873
Essex	1:10560	1876
London	1:10560	1896
Essex	1:10560	1920-1921
Essex	1:10560	1938
Historic Aerial Photography		1945-1950
Ordnance Survey Plan	1:10,000	1966-1968
Ordnance Survey Plan	1:10,000	1975-1976
Ordnance Survey Plan	1:10,000	1990-1992
10k Raster Mapping	1:10,000	1999
10k Raster Mapping	1:10,000	2010

D2 Cartographic summary

Table 13: Cartographic summary - historical development

Map date (scale)	The application site	Outside of the application site
1868-1873 (1:10,560)	Open fields	Lea navigation to east, Angel Road Crooks Ferry crossing point to south-east. Tottenham and Edmonton to the south.
1876 (1:10,560)	Not shown	Chingford Hall farm show to east of a subsidiary channel of the River Lea
1896 (1:10,560)	Southern part of the site occupied by unlabelled features – possibly pens	Eley's Cartridge works established to west of site, Angel Linoleum works to the south-east and Chingford Mill Pumping Sation to the east.
1920-1921 (1:10560)	Unlabelled features now gone. Wharf marked on Lea Navigation. Site indicated as marshland.	Eley's Cartridge Works expanded. Pegamid works established to north-west. Sewage pumping station immediately to the south of the site. Banbury reservoir shown. Sparklet works established south of Angel Road.
1938 (1:10560)	Drains shown running south from Deephams	Eley's Cartridge Works replaced by wireless, zinc, clothing and furniture factories. North Circular Road constructed to south. Deephams sewage works beds established to north.
1945-1950 (AP)	No change	No change
1966-1968 (1:10,000)	No change	Eley's Industrial estate further developed. William Girling reservoir complete. Chingford Hall moat no longer shown.
1975-1976 (1:10,000)	Sludge lagoons at Deephams STW extend into northern part of site. Incinerator constructed.	Deephams STW extended southward.
1990-1992 (1:10,000)	No substantive change	No substantive change
1999 (1:10000)	Sludge lagoons partially replaced by buildings	No substantive change
2010 (1:10000)	Sludge lagoons entirely replaced by buildings	No substantive change

D3 Historic OS maps



Entec

Middlesex

Published 1868 - 1873

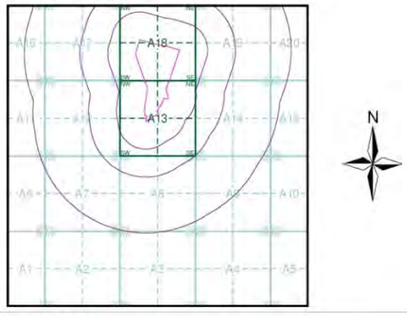
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

00700 1868 1:10,560	00800 1868 1:10,560
01200 1873 1:10,560	01300 1873 1:10,560

Historical Map - Slice A



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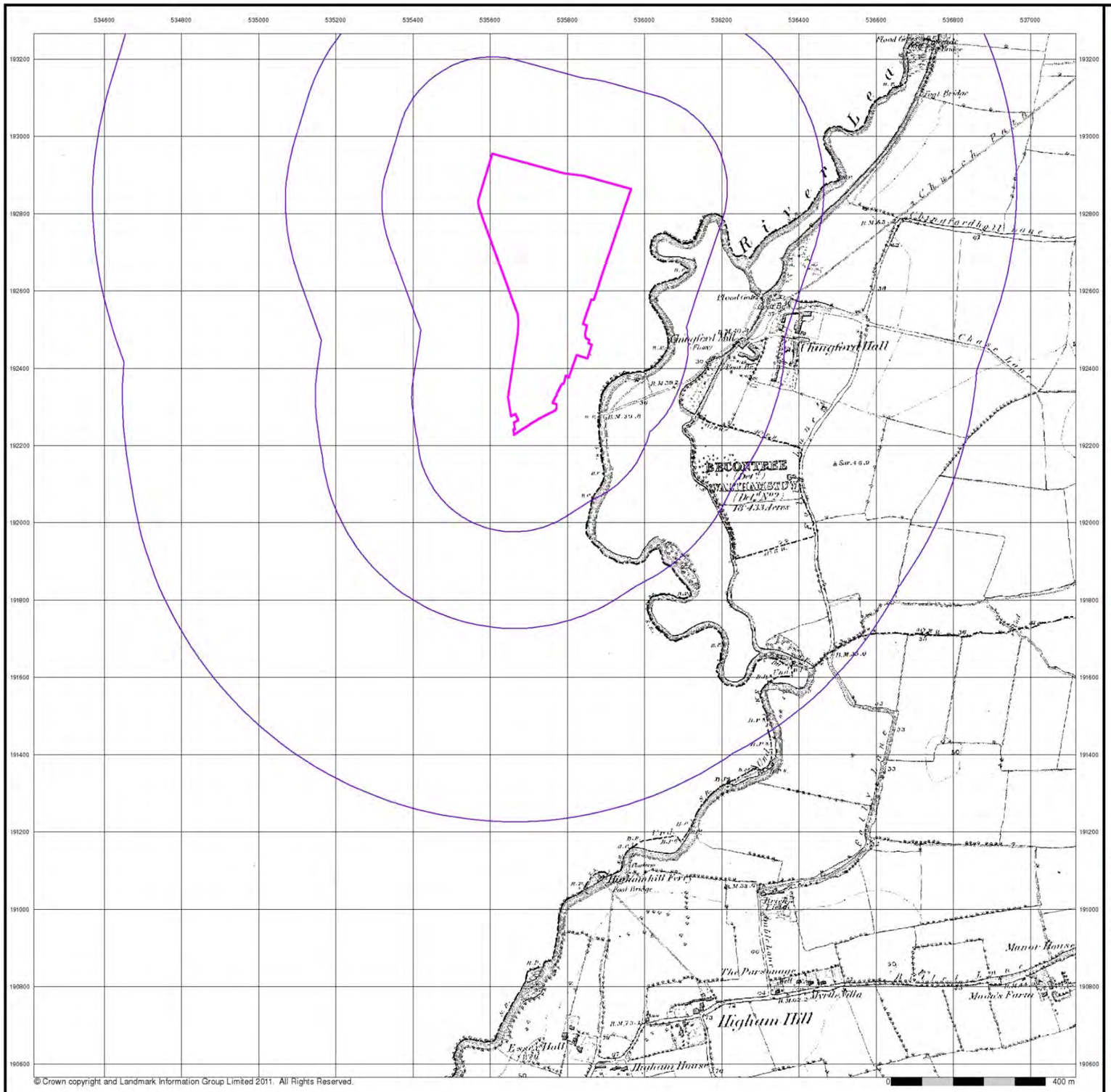
Customer Ref:	29541-01
National Grid Reference:	535740, 192370
Slice:	A
Site Area (Ha):	15.59
Search Buffer (m):	1000

Site Details

Edmonton Ecopark, Advent Way, Edmonton, Enfield, N18 3AG

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Entec

Essex

Published 1876

Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

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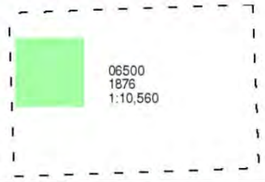

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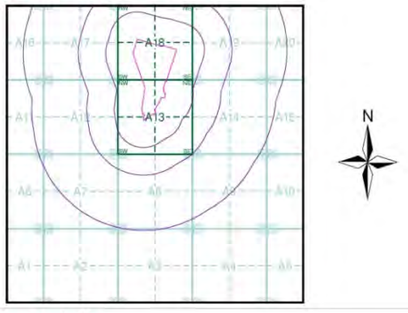

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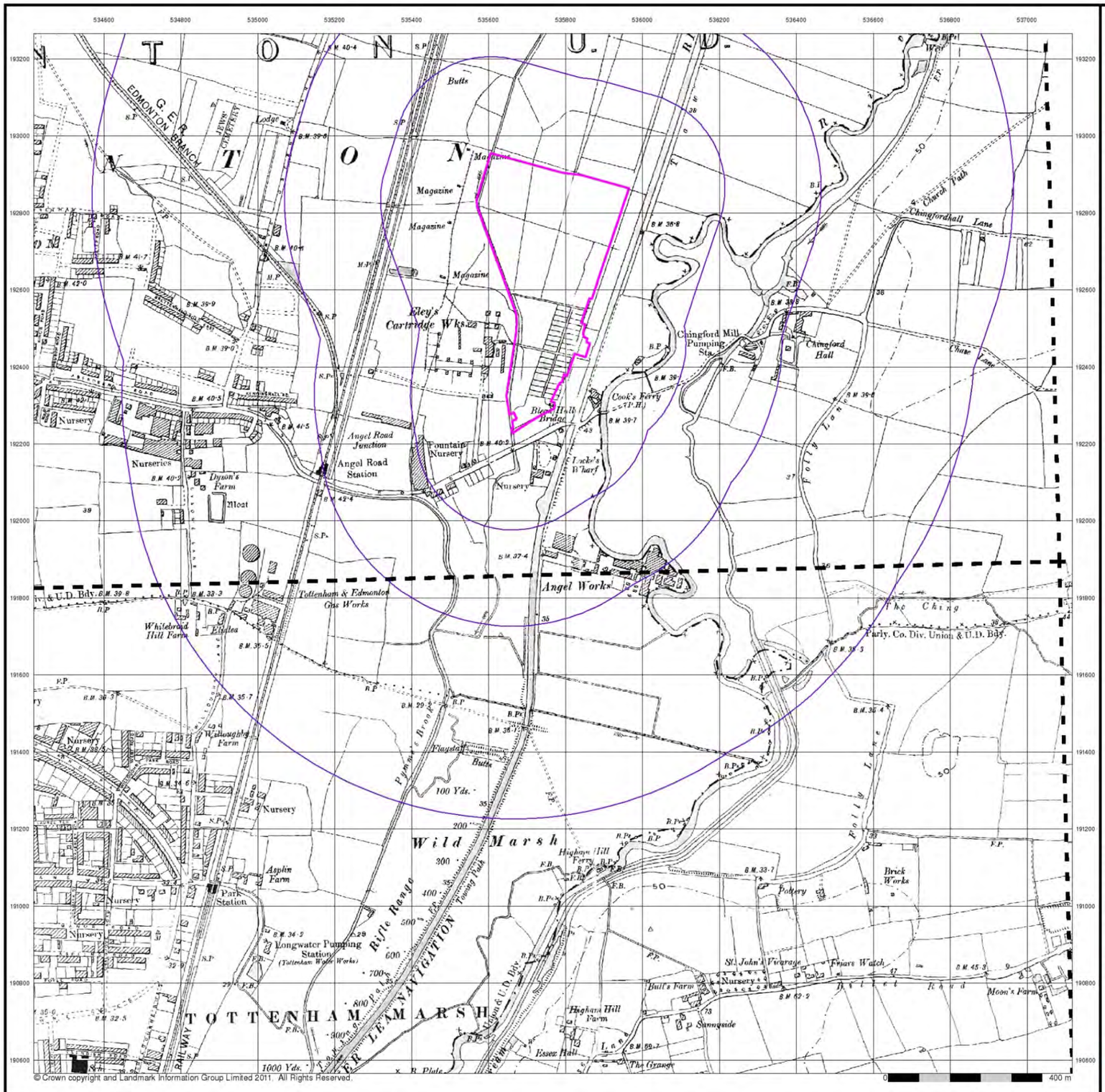

Entec

London

Published 1896

Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

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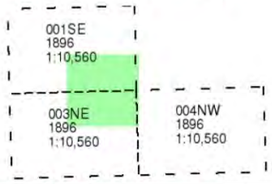
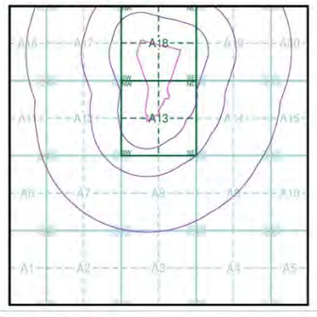


Historical Map - Slice A



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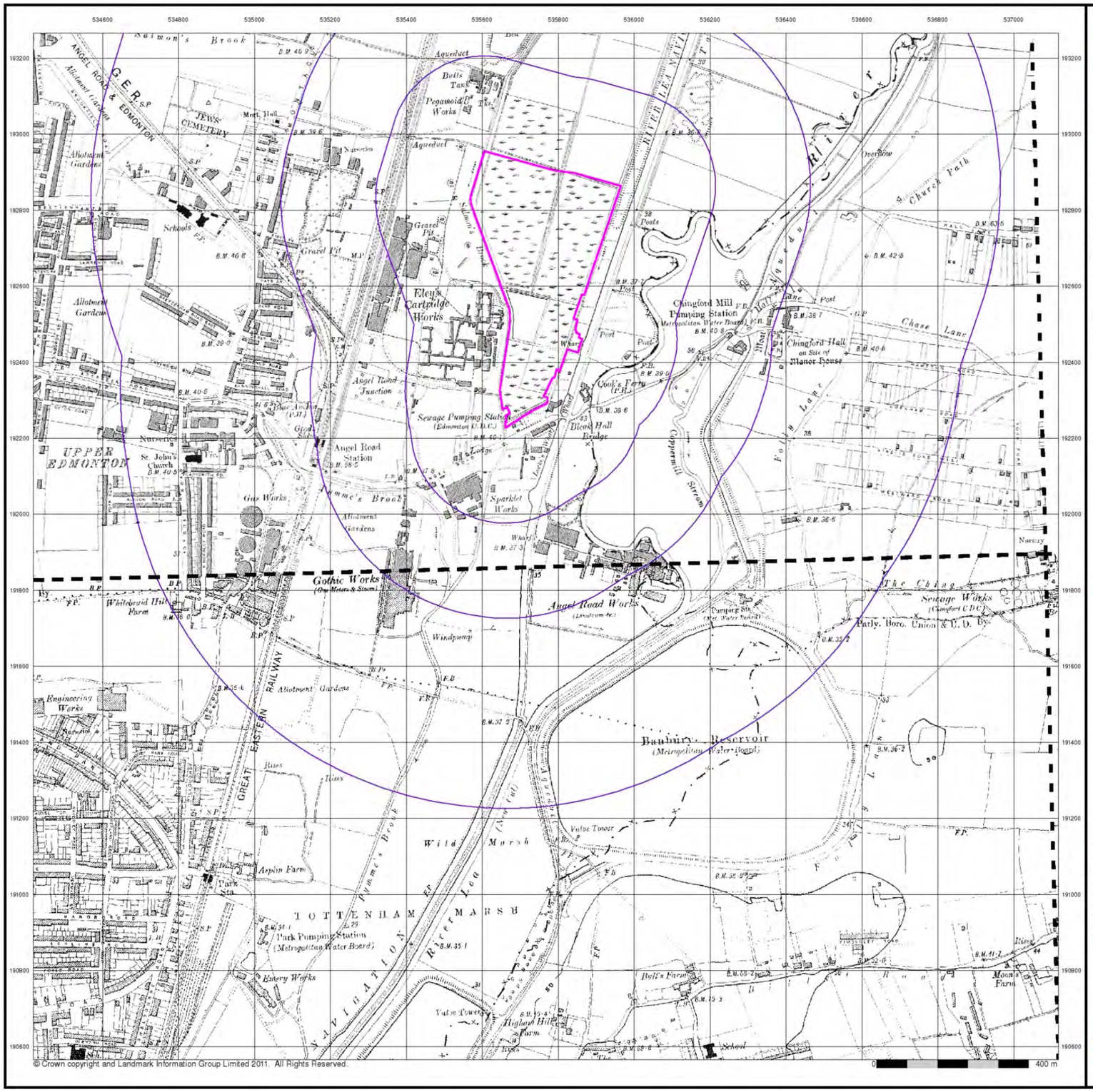

Entec

Essex

Published 1920 - 1921

Source map scale - 1:10,560

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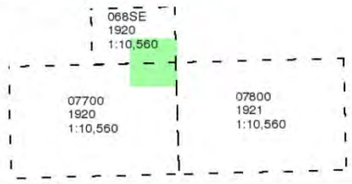

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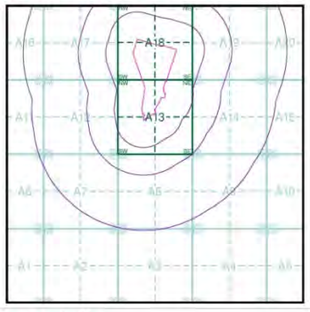

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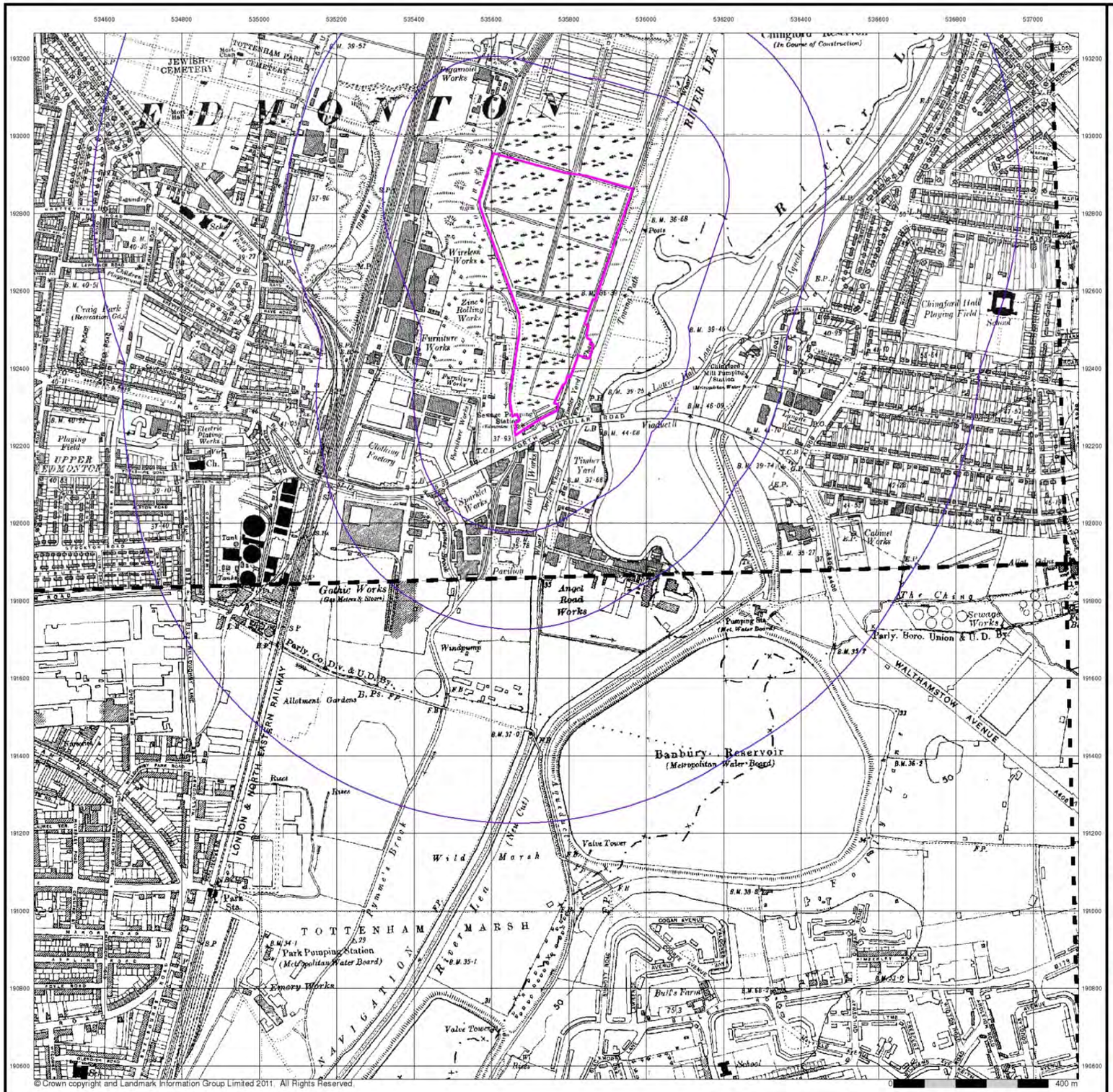

Entec

Essex

Published 1938

Source map scale - 1:10,560

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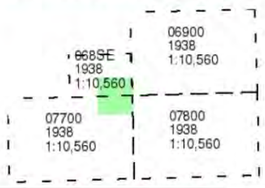

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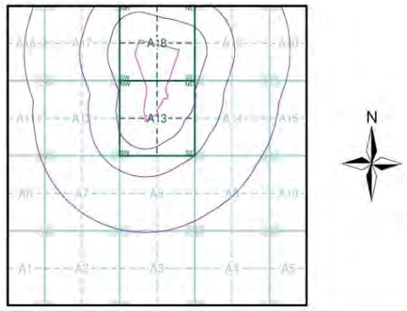

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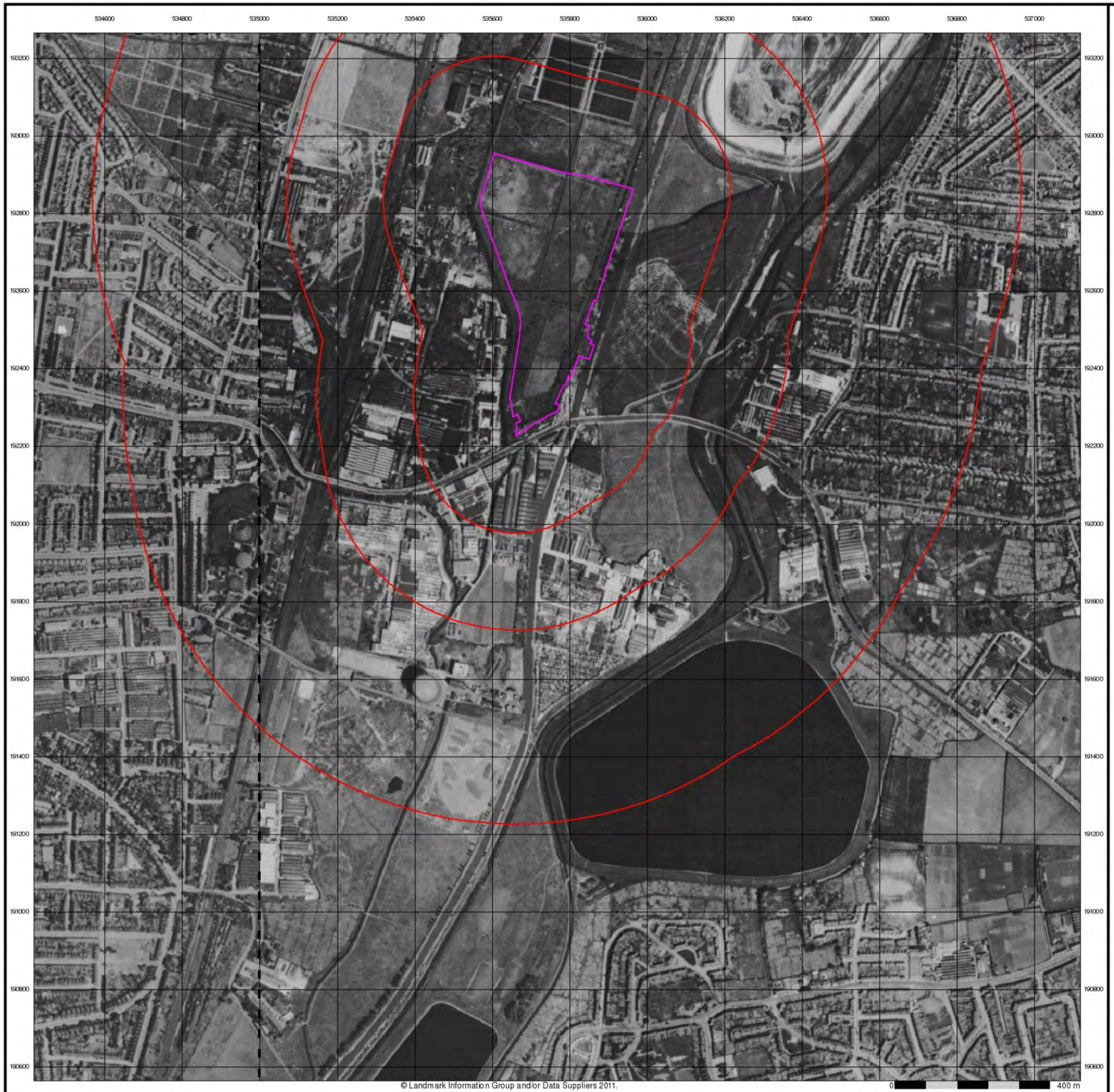


Entec

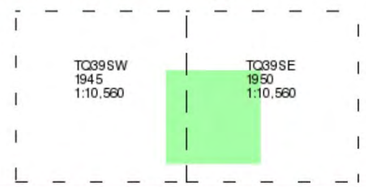
Historical Aerial Photography

Published 1945 - 1950

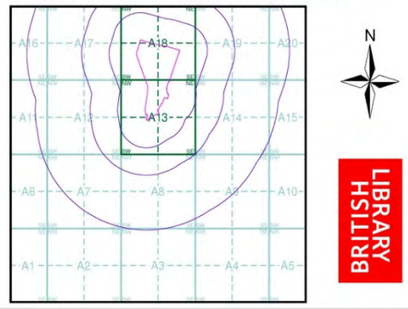
Source map scale - 1:10,560

The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

Map Name(s) and Date(s)



Historical Aerial Photography - Slice A



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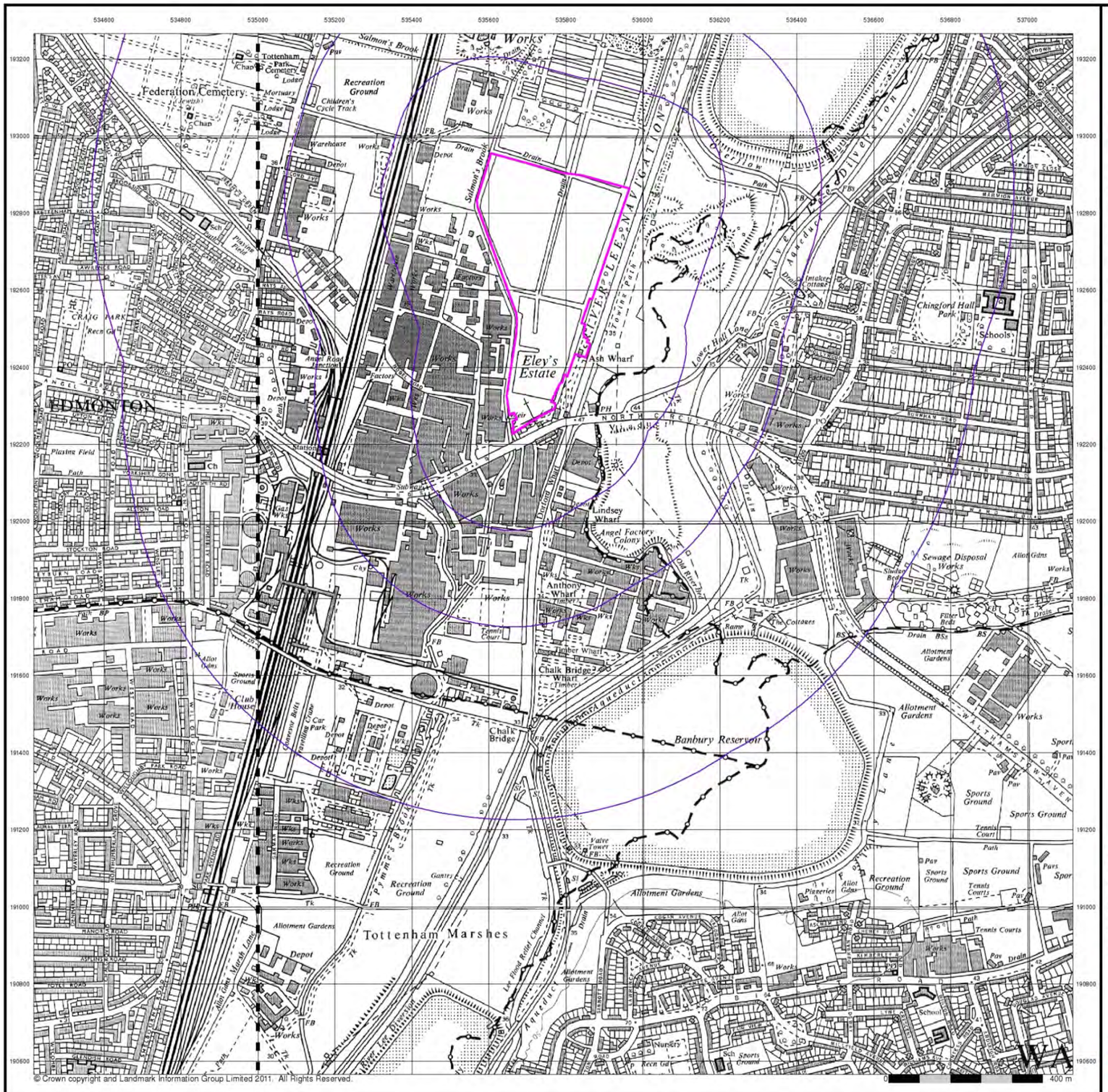

Entec

Ordnance Survey Plan

Published 1966 - 1968

Source map scale - 1:10,000

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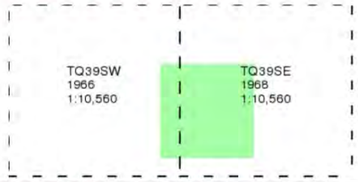
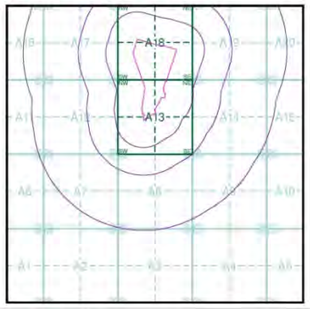


Historical Map - Slice A



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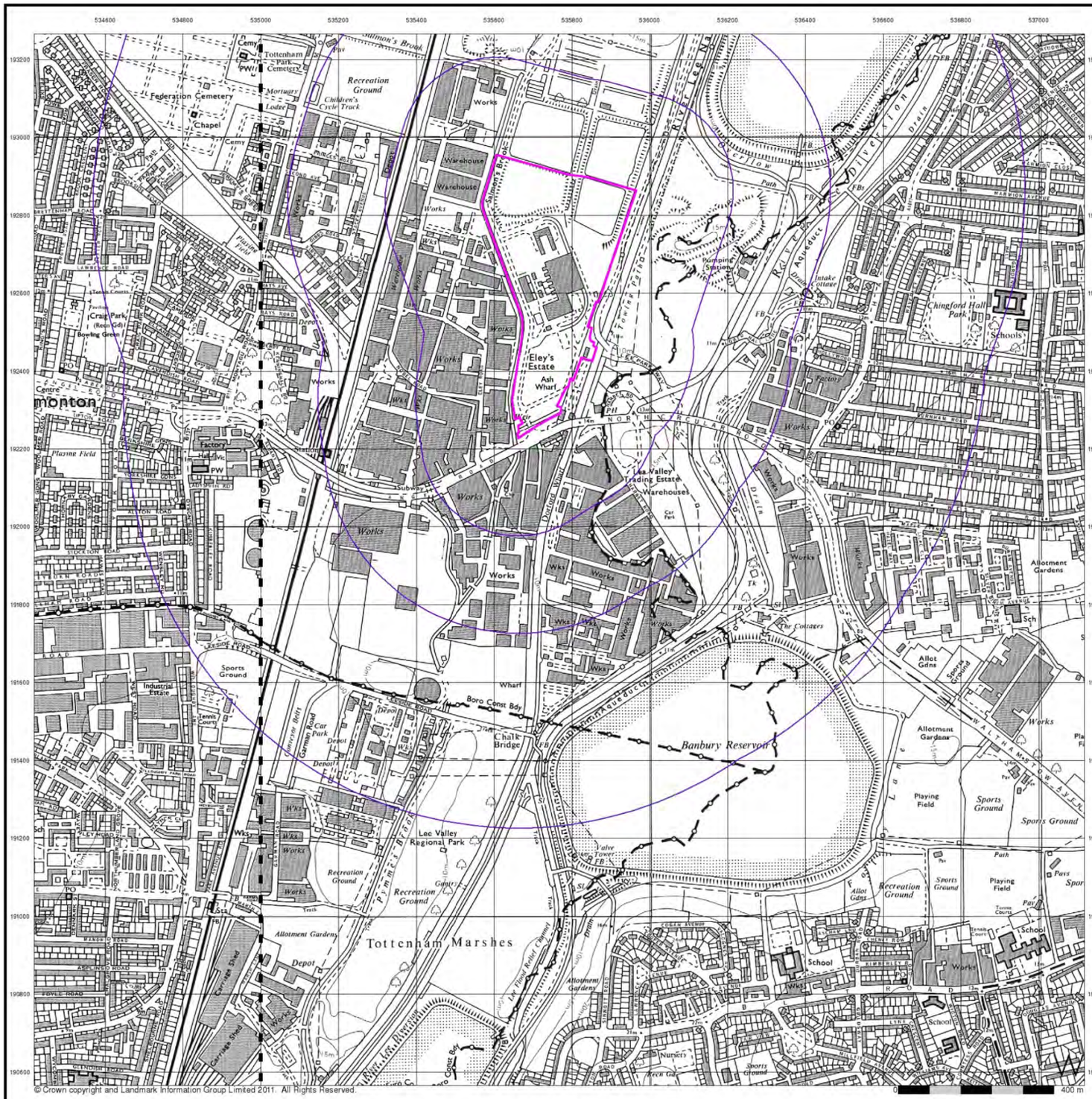

Entec

Ordnance Survey Plan

Published 1990 - 1992

Source map scale - 1:10,000

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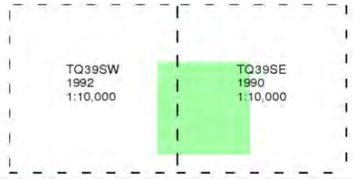
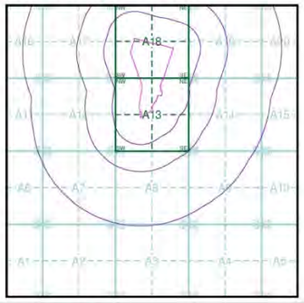


Historical Map - Slice A



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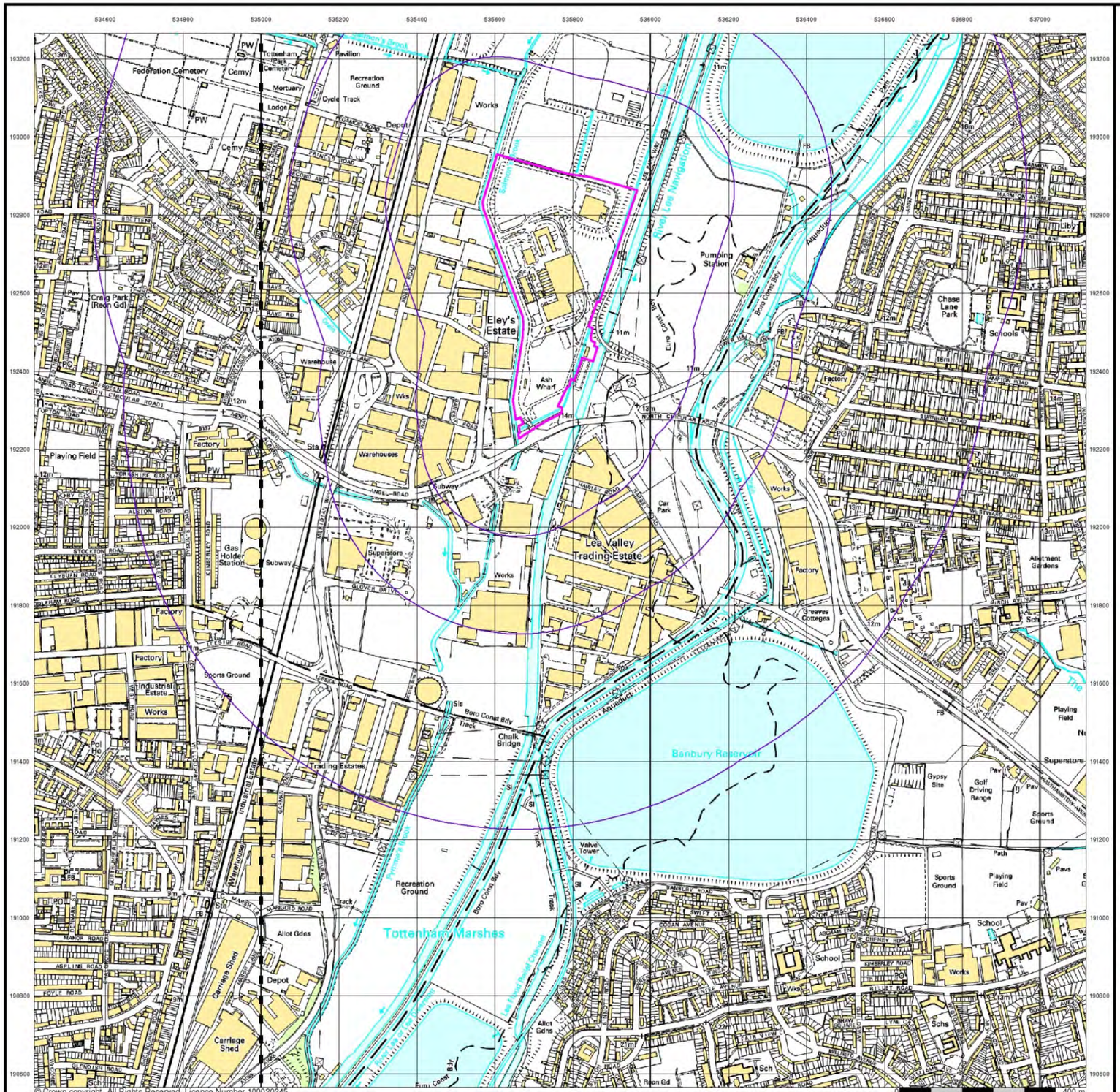
Search Buffer (m):	1000

Site Details

Edmonton Ecopark, Advent Way, Edmonton, Enfield, N18 3AG

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Entec

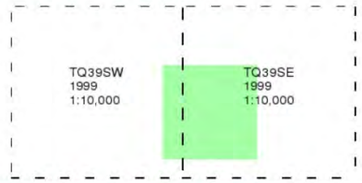
10k Raster Mapping

Published 1999

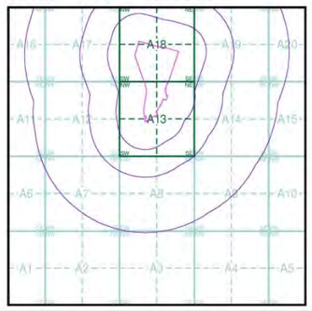
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Customer Ref:	29541-01
National Grid Reference:	535740, 192370
Slice:	A
Site Area (Ha):	15.59
Search Buffer (m):	1000

Site Details

Edmonton Ecopark, Advent Way, Edmonton, Enfield, N18 3AG

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
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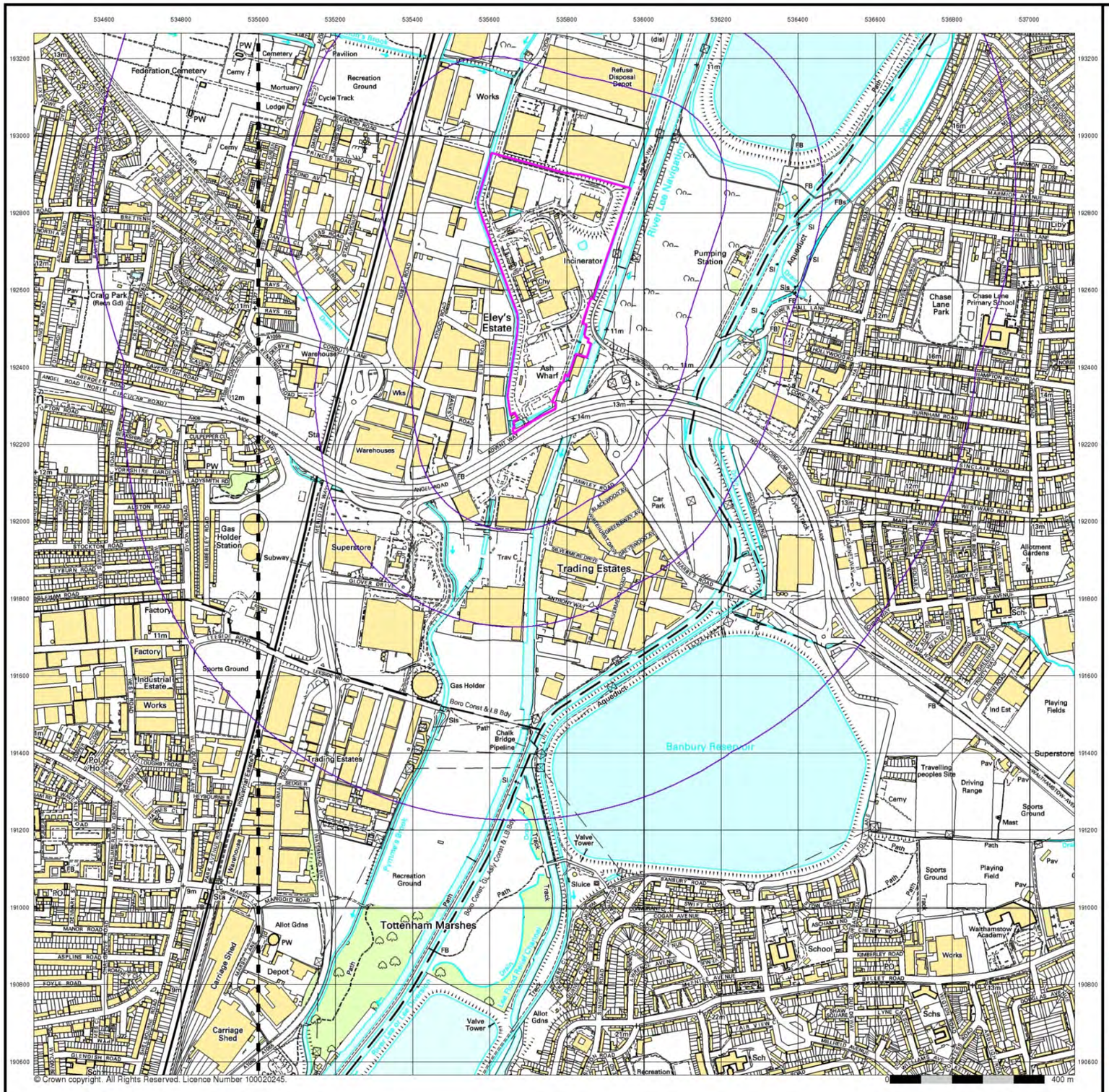

Entec

10k Raster Mapping

Published 2010

Source map scale - 1:10,000

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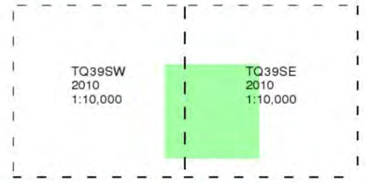
Map Name(s) and Date(s)



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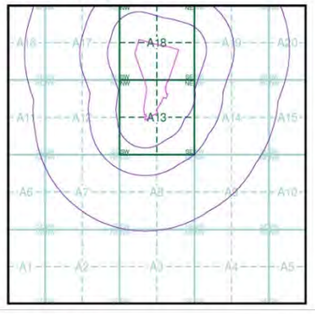

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Appendix E

Geoarchaeological deposit model

NORTH LONDON HEAT AND POWER PROJECT
Edmonton Eco Park
Advent Way
London N18

London Borough of Enfield

Geoarchaeological deposit model

April 2015

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North London Heat and Power Project
Edmonton EcoPark
Advent Way
London
N18 3AG

London Borough of Enfield

Geoarchaeological Deposit Model

National Grid Reference: 535760 192670

Project Manager Craig Halsey
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Sign-off history:

Issue No.	Date:	Prepared by:	Checked/ Approved by:	Reason for Issue:
1	30/03/15	Graham Spurr	Craig Halsey	Draft for client review
2	02/04/15	Graham Spurr	Craig Halsey	Updated following client comments
3	24/04/15	Graham Spurr	Craig Halsey	Updated following client comments

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Summary

This report presents the results of a geoarchaeological desk–based assessment (deposit model) carried out by Museum of London Archaeology on the site of Edmonton EcoPark. The report was commissioned by ARUP from Museum of London Archaeology (MOLA) on behalf of the North London Waste Authority.

The report presents the results of a geoarchaeological examination of geotechnical borehole and window sample logs taken across the site. By modelling the buried stratigraphy and preliminarily reconstructing the evolving landscape of the site, deposits of likely archaeological and palaeo-environmental potential are identified and the impact of the proposed development on the deposits of interest assessed.

Three landscape zones (LZ's) each with varying levels of archaeological and palaeoenvironmental potential have been identified across the site. These are summarised below.

LZ 1 is situated on the northern part of the site within the vicinity of the proposed Energy Recovery Facility (ERF). On this part of the site the Late Pleistocene gravels form a low terrace the surface of which occurs at c 8.5m AOD. The Pleistocene gravels are overlain by c 1 to 2m of Holocene floodplain deposits consisting of wetland peats and overlying overbank flood deposits. The floodplain deposits are sealed by c 4-6m of modern made ground. In places the alluvial floodplain deposits have been entirely removed by modern truncation. However, boreholes within this zone indicate that the basal floodplain gravels may contain organic deposits that are known as the Lea Valley Arctic Beds. These relate to a cold period nearing the last glacial maximum and may preserve flora and fauna from 26,000 to 21,000 years ago. Therefore this zone should be regarded as being of low archaeological potential but moderate to high palaeoenvironmental potential.

LZ 2 is located predominately on the northern and central area of the site and extends as far south as the proposed Resource Recovery Facility (RRF). Here the underlying gravel topography exists at c 8m AOD sloping to c 6.8m AOD towards the south. The overlying alluvial sequence is dominated by c 1 to 2m of late prehistoric/historic silty clay deposits that represent channel deposits of the Lea as it meandered across the site. The alluvial sequence is sealed by c 2 to 3m of made ground. In places the alluvial sequence has been entirely truncated. The zone has a moderate potential to contain palaeoenvironmental remains within the silts and clays that could be utilised to reconstruct river hydrology. These sediments may also contain structural and artefactual remains associated with the exploitation of the channels (i.e. jetties, boats, wharfs etc.). The zone should therefore be regarded as being of moderate palaeoenvironmental potential and low to moderate archaeological potential.

LZ 3 is located on the western, south-eastern and southern areas of the site. Parts of the RRF fall within this zone. The foot print of the proposed Reception Building falls entirely within this zone. The gravel topography occurs at between c 6.4m AOD to 8m AOD. The undulations in the gravel topography suggest that the zone represents ecotonal channel marginal areas and deeper incised channels. The gravels are overlain by a peat and alluvial sequence that in places exceeds c 2m in thickness. The deposits within this zone appear to have suffered less truncation than those in

LZ 1 and 2. This zone should therefore be considered to have the highest palaeoenvironmental potential across the site as a whole.

LZ 3 is considered to have moderate archaeological potential. Evidence of Mesolithic activity (i.e. flint scatters) may be expected to occur within soils that developed across the surface of the floodplain gravels. In addition to this evidence of wetland exploitation, in the form of timber trackways, may occur within the overlying peat deposits.

The results of the deposit model indicates that the excavations for the new foundation slabs for the Resource Recovery Facility (RRF) and the Reception building (located within LZ 2 and 3) may impact on the upper alluvial deposits. However, these deposits consist of inorganic alluvial clays and silts and are therefore of low palaeoenvironmental and archaeological potential. The slab foundations for the Energy Recovery Facility (ERF) located on the northern part of the site (within LZ 1) will only impact on modern made ground deposits.

Some degree of piling is proposed for all three buildings and this will impact locally on the deeper parts of the floodplain sequence. The construction of the c 10m deep Bunker within the ERF building will remove all surviving floodplain deposits and may impact on the Arctic Beds.

The design proposals are at the preliminary stage and the design of the slab foundations and the piling layout has yet to be determined. In light of the anticipated impacts it is recommended that mitigation takes the form of a geoarchaeological watching brief on the ground works for the construction of the slab foundations for the RRF building and the Reception Building. A watching brief should also be undertaken on the ERF Bunker. The impact of the piling could be mitigated by a targeted borehole survey to examine and sample any floodplain deposits of significance that may be present.

The scope of mitigation will need to be decided in consultation with the client and GLAAS once the design proposals are finalised.

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1 Introduction

1.1 Site background

The Edmonton EcoPark site is bounded by the River Lee Navigation to the east, Advent Way to the South, Salmon's Brook to the west and the former Deepham's Sewage Works to the north. The site covers 15.5 hectares (ha), with existing energy and waste buildings covering the majority of the central part of the site with the remainder of the site occupied by ash sifting, composting and other ancillary facilities (Arup 2014). The topography of the proposed development site varies between 10.9m and 14.5m above Ordnance Datum (AOD) across the site sloping, in general, gently southward from 12m to 11m AOD on average. The NGR for the centre of the site is 535760 192670 (Fig 1).

1.2 Site status

There are no scheduled monuments, listed buildings, local listed buildings, battlefields, world heritage sites or registered parks and gardens within the proposed development site (Arup 2014).

1.3 Origin and scope of the report

This report has been commissioned from Museum of London Archaeology (MOLA) by ARUP on behalf of the North London Waste Authority. The Greater London Archaeological Advisory Service (GLAAS) have recommended that a desk–based geoarchaeological assessment (a deposit model) be undertaken in order to determine the site's archaeological and palaeo-environmental potential. This report has been prepared within the terms of the relevant standards specified by the Institute of Field Archaeologists (IFA 2001).

A geoarchaeological deposit model provides information about the archaeological resource by examining existing geotechnical data relating to the site. The results are used to assess the potential of the deposits preserved on the site for the survival of archaeology and palaeo-environmental remains.

A geoarchaeological deposit model can be particularly useful when dealing with prehistoric floodplain archaeology (Howard and Macklin 1999), as in such areas archaeological deposits and ancient landsurfaces are likely to be deeply buried below historic alluvium. The alluvium generally precludes the discovery of stray finds, which, when the archaeology lies close to the surface can give an indication of the existence and nature of the buried archaeological resource even when none has been formally excavated. Geoarchaeological assessment of the sub–surface stratigraphy can however, produce a model that can be used to help predict where archaeological and/or palaeo-environmental remains are likely to be found.

A geoarchaeological assessment is also of value when only a low level of cultural remains is likely to be preserved in the alluvium on the site, but there is likely to be good potential for the reconstruction of the prehistoric and historic landscape inhabited by people in the past from soils, sediments and their ecological inclusions.

In these cases the assessment can help predict where palaeo-environmental deposits (with the potential for reconstructing past landscapes) and indirect evidence of human activity are likely to exist. Such topographical data, providing information about past environments is increasingly required by English Heritage, in order to better understand the distribution of archaeological sites and the activities of people in the past (English Heritage 2002 & 2004).

Note: within the limitations imposed by dealing with historical material, maps and geotechnical data the information in this document is, to the best knowledge of the author and MOLA, correct at the time of writing. Further archaeological investigation, more information about the nature of the present buildings, and/or more detailed proposals for redevelopment may require changes to all or parts of the document.

1.4 Aims and objectives

The geoarchaeological deposit model of the Edmonton EcoPark site will look in detail at the sequence and distribution of sub–surface deposits across the area by examination of geotechnical data and by consideration of landscape position and geological setting. By interpreting the environments, landscape features and depositional / post–depositional processes likely to be represented by the site stratigraphy and by reference to archaeology (and palaeo-environmental evidence) preserved in similar deposits / landscape positions in the locality, information will be gained about the potential archaeological resource on the site.

The aim of the modelling exercise is to provide information about the site's palaeo-environmental context and its topography in order to identify areas of higher and lower archaeological potential. The model will draw on geotechnical borehole and window sample data to create transects through the buried deposit sequence in order to understand how the environment and archaeology of the site has changed and developed over time. This will be complemented with topographic plots illustrating the surface of the 'early Holocene' or Mesolithic landscape. This represents the topography over which the archaeological and palaeo-environmental deposits of interest have accumulated since the last major glacial period.

1.5 Proposed development summary

The development proposals comprise the construction of three facilities in the main: the Energy Recovery Facility (ERF) to the north of the site, which in part contains a particularly deep 'Bunker' area; the Resource Recovery Facility (RRF) in the southern area and the Reception Building just to the east of the RRF (see Figs 3 & 11; NLWA 2014; Arup 2014). The central area of the site is occupied by the current 'energy-from-waste' (EFW) complex. The potential construction impacts on buried remains would be derived from the demolition of existing structures, removal of slabs, new foundations, piling for foundations and bunker excavation.

2 Methodology

2.1 Geoarchaeological background

In order to understand the context of the deposits existing on the site, information has been examined from:

- Past archaeological and palaeo-environmental work undertaken in the area (Humphrey *et al* 2008; OAS, 2010, 2011; Spurr 2006, 2007)
- Geotechnical data describing the characteristics of the bedrock, soils and substrate in the area (Ground Technology, 2011 & 2014; May Guerney Professional Services, 2011)

2.2 Data collection

A number of geotechnical investigations have been previously undertaken across the site. These included 24 borehole and 35 window sample logs from May Gurney (May Guerney Professional Services, 2011) and 20 boreholes from Ground Technology (Ground Technology, 2011 & 2014). All borehole and window sample logs were complete with height and location data and detailed sedimentological descriptions. The window sample logs on the whole however did not reach to the level of the underlying Pleistocene deposits (which form the baseplate for the deposit model) and, therefore, were not used. As a result, 39 borehole and 4 window sample data points were utilised which, on the whole, provided good, reliable coverage across the site area.

2.3 Deposit model construction

In order to create the deposit model the data was entered into a digital (Rockworks 15) database.

Each lithological unit (gravel, sand silt etc.) was given a unique colour and pattern allowing cross correlation of the different sediment and soil types across the site. By examining the relationship of the lithological units (both horizontally and vertical) in a series of working transects, correlations can be made between soils and sediments, and associations grouped together on a site–wide basis.

The grouping of these deposits is based on the lithological descriptions, which define distinct depositional environments, coupled with a wider understanding of the Thames floodplain sequence gained from previous archaeological and geoarchaeological investigations undertaken in the surrounding area. Thus a sequence of stratigraphic units ('facies'), representing certain depositional environments, and/or landforms can be reconstructed both laterally and through time for the site.

The Rockworks data was transferred to Arc GIS v.10 and a Surfer Plot module was used to create a 2D and 3D interpretation of the 'Early Holocene surface' (Fig 2), which plots the surface topography of the Pleistocene gravels and sands. This gives an approximation of the topography of the site as it existed at the beginning of the Holocene period (i.e. the early Mesolithic, *c* 10 000 years ago). The development of the Holocene floodplain is likely to have been influenced by the gravel topography inherited from the Pleistocene period. This surface

would have dictated the course of later channels, with gravel high points forming areas of dry land within the wetlands, and lower lying areas forming the main threads of later channels.

2.4 Reliability of the model

The data set consists of 43 fairly well spaced data points particularly within the northern and southern areas of the site with a relative paucity of data toward the middle of the site. This data is considered a good representation of the deposits across the site as a whole. The data points used to create the transects and plots for the main area of the site are indicated on the figures.

2.5 Preparation of the report

The results of the deposit model are discussed in section 4, in terms of the evolving Quaternary landscape on the site. The results were compared to what is already known about the geoarchaeology of the area (as summarised in section 3) and, as a result of the better understanding of the past landscape of the site itself, afforded by the deposit model, assessments have been made regarding key areas of potential for archaeology and the preservation of palaeo-environmental remains (section 5). Based on the inferred impact of the proposed development on the archaeological resource, recommendations for further archaeological investigation are suggested in section 6.

3 Geoarchaeological background

3.1 Introduction

In this section the landscape evolution and associated archaeology of the Edmonton Ecopark site area of the Lea Valley is summarised (note for the purposes of this report 'Lea' refers generally to the natural course of the river where it exists and 'Lee' to the canalised sections of the river such as the Lee Navigation). It forms the necessary background to interpret the deposit model produced for the site and to assess the potential of the alluvial sequence. The deposits which are likely to occur on the site, with associated archaeology, are described in chronological order from the oldest to the most recent. Dates in BP, refer to before present (i.e. before 1950), and are given as calibrated radiocarbon dates in this section and throughout the report.

3.2 Timescales

Human activity in Britain has taken place during the period of geological time known as the Quaternary, which spans the last 2 million years and is characterised by the climatic oscillations known as 'the Ice Ages'.

The Quaternary is subdivided into the:

Pleistocene:	2 million –10,000 BP (years before the present)
Holocene:	10,000 BP – present

Although hominins are known to have existed in other parts of the world from the beginning of the Quaternary, if not earlier, the earliest evidence for human activity yet found in Britain has been dated to the latter part of the Quaternary, about 1,000,000 years ago.

The archaeological timescale, charting the development of human activity in Britain through time, is as follows (Renfrew *et al*, 2012):

Prehistoric	
Palaeolithic (ancestral humans: hominins):	1,000,000 – 10,000 BP
Mesolithic (hunter gatherer foragers):	10,000BP – 4,000 BC
Neolithic (the earliest farmers):	4,000–2,000 BC
Bronze Age (first use of metal, more complex societies):	2,000–600 BC
Iron Age (agricultural intensification; political elites):	600 BC–AD 43
Historic	
Roman:	AD 43–410
Saxon / early–medieval:	AD 410–1066
Medieval:	AD 1066–1485
Post–medieval:	AD 1485–present

The location of the site, on the floodplain of the Lea, implies that only deposits dating from the late Pleistocene will be present, as it was during this period that the present floodplain was carved out. Consequently the background section focuses mainly on the Holocene and the Late Glacial periods.

3.3 Site location and topography

The site lies on the western bank of the River Lee Navigation. The BGS Solid and Drift Sheet 256 (North London) shows that the site is positioned on a broad swathe of alluvial deposits accumulated within the floodplain. In general, the deposit sequence within the floodplain consists of the basal floodplain gravels overlain by a series of minerogenic sands and silt/clays interstratified with peat deposits. Ground levels in general, slope gently southward from 12m to 11m AOD on average, but can reach a maximum of 14.5m and a minimum of 10.9m AOD in localised areas.

3.4 Pre-Quaternary geology

The outcrop pattern of the rocks in the Greater London area is closely related to the geological structure, which is dominated by the London Basin, a gentle synclinal fold, with its axis aligned west to east. The older rocks outcrop on the edge of the syncline: the Cretaceous Chalk of the Chilterns (in the north) and North Downs (forming the southern rim of the London Basin) in the south. Younger geological strata: Tertiary sands and clays, infill the centre of the syncline, which is followed, for the most part, by the Thames.

Underlying the site the pre–Quaternary deposits consist of the Eocene London Clay Formation which is predominately made up of bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay. The bedrock pre–dates the evolution of hominin groups and has no archaeological potential in itself, although its characteristics often determined the nature of succeeding environments and the landscapes occupied and exploited by communities in the past. On the floodplain of the Lea however, the impact of the bedrock is reduced, as it is mantled by Quaternary deposits which, in general, mask its characteristics and contours.

3.5 Quaternary deposits

Pleistocene floodplain gravels

During the Pleistocene successive cold and warm climatic oscillations have caused alternating downcutting and aggradational cycles to take place which, together with a background gradual tectonic uplift, has led to a sequence of progressively younger Quaternary deposits down the (Thames) valley sides. These mainly gravel deposits form a series of terraces, which represent former floodplains of the Thames that subsequently became incised and left high and dry as the river down cut to lower levels.

As a result, the wider Thames terraces form the basis to the River Lea's own suite of terraces which built up as the Lea concurrently incised down as the Thames down cut. The terraces to the Lea however have acquired their own nomenclature largely through the work of Gibbard (1994). The present floodplain represents the most recent stage in this sequence. It was created as the river down–cut from a former, higher, floodplain (represented by the Leyton Gravels of the Lea or the Thames Kempton Park Gravels equivalent), as a result of the low sea–level and the large influx of meltwater which occurred after the Last Glacial Maximum of the Devensian Glacial period (*c* 18 000 BP). It subsequently deposited coarse grained sediments across the valley floor and these deposits (the Lea Valley Gravels of the Lea which equates with the Shepperton Gravel of the Thames) underlie the alluvium in the present floodplain and across the site (Gibbard 1994, Corcoran *et al* 2011).

The gravel was deposited in a network of braided, ephemeral channels at a time when the Thames and Lea had similar characteristics to those rivers flowing in arctic regions today. Within the river threads, sand and gravel bars accumulated, forming an irregular surface

topography. This gravel aggradation is thought to have ceased by 15 000 BP in the Thames and its tributaries (Wilkinson & Sidell 2000). It has been suggested that the cessation of gravel sedimentation may be a result of river competence exceeding sediment supply (Collins *et al* 1996), or because the sediment supply was reduced by the stabilising effect of the dense vegetation which took hold during the Windermere/Allerød interstadial (Rose, 1995).

Palaeolithic material pre–dating the incision of the present floodplain is occasionally found within or above the Lea valley floodplain gravels, having been eroded from its place of discard on the higher older terraces and deposited with the river gravels on the valley floor. Such artefacts are usually rolled and worn and their *ex–situ* context makes them of low significance archaeologically.

The low terrace and 'Arctic Bed' deposits

Along this part of the lower Lea Valley there is a distinct low gravel terrace feature arising on the western side of the floodplain most notably occurring in the area of Meridian Way Enfield (A1055) just to the west of the site (Corcoran *et al* 2011). This low terrace feature, which lay adjacent to the floodplain lying at approximately 8m-9m AOD, would have stayed dry during the early Holocene (the Mesolithic) allowing soil development and areas for past human activity / resource exploitation.

Within the low terrace, organic deposits known as the Lea Valley Arctic Beds are known to occur. The Arctic Beds were rafts of vegetation and sediment which were probably incorporated in the gravels as frozen blocks scoured out and deposited by fast flowing meltwaters and were first recorded by Warren (1912) at Picketts Lock, Ponders End and, in fact, exposed in sections at Deephams Sewage works just 800m to the north of the proposed development site during excavations in the mid-twentieth century (Haywood, 1956) and more recently during a watching brief undertaken by Oxford Archaeology at the same site in 2011 (OAS 2012). Here rafts of pebbly buff to black sandy clay c 1m long and 0.3m thick were observed at c 6m AOD at the base of the gravels containing cold climate insect and plant remains and dated to 21,880 +/- 40BP (Haywood, 1956). In contrast, two distinct Arctic bed deposits were located within the gravels some 6.5m below ground level in 2011 and were dated to 16 ka BP and 12 ka BP, much later than previous deposits and post-dating the glacial maximum (18,000 BP; OAS 2012). These have been therefore classified as 'sub-Arctic Beds' and are indicative of the complexity of the stratigraphy local to the site area in this part of the Lea Valley.

Prehistoric deposits

In tandem with the general model for the landscape evolution for the Lower Thames floodplain area following the deposition of the floodplain gravels and before the impact of rising relative sea level (RSL) was felt in this part of the Lower Thames Valley, a period of landscape stability existed in the early Mesolithic, when wetland developed in low lying areas of the floodplain and soils on the higher ground and interfluves (Bates and Whittaker, 2004 and Stafford *et al* 2012).

In contrast with the Thames however, where evidence of the Mesolithic environment is rare because of subsequent erosion, widespread peat deposits survive in the Lea Valley dating from the early Holocene (Mesolithic) such as at the Ikea site (500m to the south of the site) where the onset of the peats were dated to 9370-9240 BC (Spurr, 2007) and known elsewhere to exist through to the Neolithic/Bronze Age periods (OAS 2012).

At this time the floodplain was becoming more organic with humic muds and peats extending across the valley floor infilling former pools and abandoned river channels. The pollen records from other sites tend to show local variations along the Lea (in comparison to the general picture of pollen records in the SE of England) but in general the pollen describes a

landscape dominated by grass and Hazel with Birch initially, then Pine and isolated Oak-dominated woodlands typifying the tree pollen throughout later becoming thick stands of deciduous forest on the higher ground (Spurr 2006, 2007).

Interestingly, evidence of anthropogenic activity in terms of land management/clearance practices and crop production during this period has been inferred through cereal pollen and remains of charcoal and indirectly through aforementioned variations/gaps in the pollen records at the Ikea and Omega III sites on the Lea (Spurr 2006, 2007) and at Three Ways Wharf on the Colne – another tributary to the Thames to the west of London (Grant *et al* 2014). More substantial remains dating to the prehistoric might include those similar to that found at Montagu Road on the edge of higher ground 500m to the north–west of the proposed development site however, where Mesolithic flint work and evidence for site clearance and occupation from the late Neolithic into the Iron Age was recovered (ARUP 2014).

Furthermore, tufa deposits representing springs seeping onto the valley floor are frequently associated with the peat deposits in the Lea valley (often occurring at the edges of the floodplain mixed with the gravel). In Britain tufa seems to have formed in swampy woodland under the more humid climatic conditions that were present in the Mesolithic as noted at the Ikea site (Spurr 2007; Humphrey *et al* 2008). These deposits can effectively fossilize plants, for example, and provide an alternative palaeo-environmental resource such as those found at Cherhill in Wiltshire, where tufa imprints of plant leaves and snails were recorded (Evans *et al* 1983).

Later prehistoric/historic minerogenic deposits

Relative sea level rise during the later prehistoric and historic periods led to the upstream encroachment of estuarine environments into the East London Thames and Lower Lea. Beyond the limits of estuarine advance, the impact of rising relative sea level would have been to impede downstream drainage and cause flooding resulting from 'ponding back' of the river flow. Thus, increasingly wet environments might be anticipated in sediment profiles, with widespread deposits of silty clay alluvium developing. The onset of the alluvium has been dated to the Roman period locally although this will vary in time with distance from the tidal head (Spurr 2006, 2007). Across the Lea valley and particularly in the study area, the alluvium is shallower and characterised by the lateral accretion more typical of a non-tidal river although one powerful enough to erode out the prehistoric peats in part as the main channel and other branches of the river meandered across the floodplain (Corcoran *et al* 2011).

Although high quality finds of Bronze Age metalwork comprising a basal-looped spearhead, socketed knife and shield were found in marshland close to the site in 1869 and excavations at Lower Hall Lane on the east bank of the River Lea uncovered Bronze Age cremations (ARUP 2014) the area remained largely unexploited farmland up to and throughout the Roman period (Corcoran *et al* 2011). Indeed it was only from the medieval period that the Lower Lea became utilised more fully with tidal mills and large manorial complexes. Interestingly, the site area itself was still seen as open marshland subject to flooding as late as 1870 when the Sewage Works was established at Deephams along with other industrialised developments (ARUP, 2014).

Quaternary scientists and geographers are interested in the alluvial sequence for the information it provides on the pattern of local RSL rise and its implications for Holocene sea level fluctuations and climate change at a wider scale (e.g. Long *et al* 2000). Archaeologically, however, the significance of the interbedded peats and clays within the floodplain lies in the information they provide about past fluctuations in environment and thus the changing landscape available to be exploited and inhabited by people in the past. The waterlogged conditions of these deposits, also preserves evidence for historic activity, which

rarely survives on dry land sites (e.g. timber structures, wooden artefacts, wattle and matting) such as at the Ikea site where a timber structure or Crannog dated to the early Saxon period was revealed (Humphrey *et al* 2008).

Post-medieval deposits and archaeology

Post medieval archaeology has been found to exist within the upper part of the alluvium or within the lower part of the made ground deposits as recorded in the archaeological investigations associated with the Olympics 2012 (Powell, 2012).

During the 20th century however, with the growth of industrial activity along the Lea, construction of large reservoirs to the north of the site and the expansion of the Deephams Sewage complex completely removed the alluvial stratigraphy in places. Indeed, the construction of filter beds and digging of sludge lagoons in particular for the Deephams Sewage works truncated the alluvium to gravels as far south as the northern boundary of the proposed development site (ARUP, 2014).

4 Geoarchaeological deposit model

The plot of the early Holocene surface (Fig 2) provides a starting point from which to understand the evolution of the site throughout the Holocene, and also highlights the major geomorphological features. This surface plot provides an interpretation of the sub-surface contours over which the alluvial material across the site has developed and it will approximate to the landscape topography at the start of the Holocene (the Mesolithic, *c* 10 000 BP). Examination of its topography in 3D (Fig 2) will enable 'highs' and 'lows' to be identified within the floodplain and may indicate where islands, promontories, palaeochannels and so on may have existed that would have been attractive to prehistoric people and therefore may have archaeological potential. In addition, it will help consider the implications of the more irregular land surface that existed prior to the levelling-up of the landscape by the accumulation of alluvium and colluvium during the Holocene. The sediments have been grouped into facies (or groups of sedimentary units that reflect similar environments of deposition) to facilitate the interpretation of the deposits across the floodplain (see Transects 1-5, Figs 4 – 8 and Key in Fig 9).

The early Holocene topography within the site indicates the gravels (Facies 1) are higher in the north-eastern corner of the site at around 8mAOD (BH116, BH114 & BH104 in particular) with gravel lows or hollows toward the western and south-western edge of the site at 6 – 7m AOD (BH113 and BH119, respectively). Although only a difference of approximately 1.5 to 2m, this altitudinal variance probably differentiates the low terrace area to the northeast from the more ancient Pleistocene channel path in the west occupied now by the Salmon's Brook (Fig 4). This interpretation is substantiated through the presence of sand deposits accumulating in the hollows (Facies 2; Fig 4), an in-channel deposit occupying a channel thread and likely to be of Late Glacial to early Holocene date. Interestingly, organic material in the sands and associated fine grained silts (noted in the borehole logs) could indicate a semi-terrestrial environment developing late in the Pleistocene within which deposits of great antiquity may be found preserving organic environmental remains in particular.

The proximity of the low terrace to the channel presents particularly good potential for Mesolithic remains as, at this time, the low terrace would have formed a low lying topographic feature providing a high and dry area alongside the channel. Such an ecotonal region between high ground and the rich resources of the low lying channel would have made this area of the site a prime location for hunter-gatherer activities. Hence remains of Mesolithic materials (typically represented by scatters of flint and animal bone/antlers as at the Ikea site; Humphrey *et al* 2008) could be found at these locations particularly where sealed by peats in the central northern area of the site.

Another feature of the low terrace are the Arctic beds within the gravels (rafts of vegetation and sediment which were probably incorporated in the gravels as frozen blocks) noted at several isolated locations across the Lea Valley particularly through Victorian excavation for the railways most notably at Angel Road Station just 500m to the east of the site (Warren, 1912) and Deephams Sewage works (Hayward 1956; OAS 2010, 2012). Across the site area they occur in one borehole BH313 at approximately 7m AOD (Fig 5) in the northeast of the site. Although scrutinised closely during the mid-twentieth century (Hayward 1956) recently they have been dated from boreholes to indicate later periods of deposition and more modern analytical techniques could elucidate the nature of these rare deposits further.

As the volume of ice-melt water decreased by the onset of the Holocene (Mesolithic) period, thick peats (Facies 3) developed across the floodplain which still survives across the Lea Valley. The peats would have accumulated in redundant channels initially but soon, as the area became progressively waterlogged, spread further across the valley floor (including the

low terrace). In the site area peats and organic silts tend to exist in thickness of approximately 1m between 7.5m and 9m AOD (approximately 3-4m below the surface). The 'heat map' of the peat showing its thicknesses across the site (C in Fig 10) indicates survival is good along the fringes of the site and particularly good in the north and south. Notably, where the peat is at its thinnest toward the central area of the site, it was probably eroded out by meandering channels of the Lea later in the prehistoric/historic period (also see Transects 4 & 5 in Fig 7 & 8).

Peat deposits are very important archaeologically as they offer a highly preservational environment important for both palaeo-environmental proxy indicators (such as pollen) as well as artefacts. The peats can also be radiocarbon dated providing a chrono-stratigraphic framework (timeframe) for the sediments in a section as well as plotting how they spread across the site as a whole.

The accumulations of silty clay alluvium which blanket the peat across the valley floor represents overbank flood deposits which were initiated by the ponding back of the Lea as a knock-on effect of rising sea levels affecting the Thames. The alluvium gradually covered the low lying areas of the floodplain and infilled the redundant channels of the multi-threaded Lea as it meandered across the floodplain eroding the peat during the later prehistoric and historic periods.

Across the site the survival of the silty clay is variable and is best represented as a whole in the heat map and the transects (Figs 4 – 8 & 10). The thickness of the alluvium (as indeed the peats) is determined by two main factors: the level at which it began to accumulate and the degrees of truncation it has suffered subsequently. Hence, as an example, in the south east corner where relatively thick alluvium still survives (B in Fig 10; Transect 2 in Fig 5) there has been the least truncation (BH18 surviving to 10mAOD) coupled with the presence of deeper accumulations of the silty clays within redundant channel courses (e.g.BH121 from 7mAOD). Likewise at points to the north east and north west alluvium is found to survive to 2m thickness for example in BH301 (Fig 5). Conversely, in some areas toward the centre of the site only thin deposits remain and sometimes completely non-existent (truncated) for example at BH109 (Fig 5) and WS122 (Fig 8). Where they do survive the alluvial deposits, like the peat (see C in Fig 10) have high palaeo-environmental preservation potential (i.e. diatoms and ostracods) that could be used to reconstruct the past aquatic environment. In this area of the Lea Valley the alluvium is shallower than downstream closer to the influence of the tidal Thames and characterised by lateral accretion through seasonal flooding (Corcoran *et al* 2011, Spurr 2007). As a consequence survival of microfossils and artefacts is unlikely to be good except in the deeper pockets perhaps along the fringes of the channels where the remains of jetties, boats and fish traps could exist such as found on the Olympic sites (Powell 2012).

Finally, the made ground across the site area varies generally between 2 – 3m in thickness and is likely to have truncated the alluvial deposits to some degree. The heat map of the made ground (A in Fig 10) indicates it is thickest in the north and south toward the eastern boundary of the site. Indeed Transect 3 (Fig 6) indicates thick made ground coupled with complete truncation of the alluvium in places presumably due to the digging of sludge lagoons and/or ground raising to the north of the site (ARUP 2014).

5 Archaeological potential

The geoarchaeological evaluation of the sub–surface stratigraphy has produced a model that can be used to help predict where archaeological remains might be found and where palaeo-environmental deposits with potential for the reconstruction of the past landscape and human activity are likely to exist.

Although the model is considered a useful means of gaining a preliminary idea of the likely buried stratigraphy on the site and the archaeological and palaeoenvironmental potential, by no means should it be taken as the full or correct interpretation of the past environments that formerly existed here. The deposit model is intended only to act as a working tool to assist in identifying areas of archaeological interest and does not constitute a definitive statement of the environments and human activity that existed on the site in the past.

The gravel deposits across the site date to the Late Pleistocene glacial period. During this time Britain was uninhabited and therefore these deposits are of low archaeological potential although Palaeolithic material, such as hand axes may be found within these gravel deposits reworked from the older terraces. Such material should be considered, however, *ex–situ*. In contrast, Arctic Bed deposits, known to occur in this area of the Lea, provide rare local environmental data for the latter part of the Pleistocene.

The site is situated between an early channel feature to the west and the relatively higher ground of a low terrace to the north and east. The site has always therefore been a river marginal environment and as such has potential for ecofatual or artefactual preservation particularly toward the channel areas. Across the bulk of the site however, survival of early prehistoric archaeological artefacts is considered low, given their antiquity and largely ephemeral nature although, if surviving, would most likely be preserved beneath and within the peats on top of the low terrace or any raised gravel surfaces ('highs'), particularly in proximity to the channel to the west of the site. Here any archaeological evidence is likely to take the form of flint scatters and burnt material relating to temporary occupation as for example, at the Ikea site (Humphrey *et al* 2008).

The overlying peat and silty clay deposits that overly the gravel surface relating to the prehistoric floodplain are of high potential archaeologically, particularly in terms of palaeo-environmental remains. These sediments will preserve a different range of environmental indicators particularly within the peat deposits. The peat deposits are thickest in general around the margins of the site and the western fringes in particular. In the central area of the site the peat was found to be at its thinnest (if at all present) probably due to historic channel migration and scour. Although these semi–terrestrial / waterlogged floodplain marsh and woodlands would not have been suitable for any permanent form of settlement during prehistoric, the wetlands would have provided a range of subsistence resources likely to have been utilised during this period (e.g. fishing, hunting and gathering). This marshland environment would have been difficult to traverse, requiring the construction of timber trackways to access. Although physical evidence such as branch lain trackways have been found occasionally across the peat deposits along the Thames, they have never been found in the Lea.

The overlying fine–grained deposits which bury and erode the peats represent a change in the nature of the Lea may preserve diatoms, molluscs and ostracods which will provide data on the changing climate and the hydrology of the site. These proxy indicators are important for understanding the evolution of the Lea and the knock-on effect of tidal head migration and relative sea level rise affecting the Thames valley as a whole. Although these deposits are generally poor in terms of archaeological survival, they may contain evidence of historic

interaction with the channel such as timber wharfs, jetties, boats and fish traps particularly from the Saxon period. Importantly they are also an indicator, where thick - as particularly in the south east of the site - of the least truncation. In turn however, where they are thickest they often indicate historic channel routes which may have completely eroded out the underlying microfossiliferous peats. The site would have remained marshy until well into the post medieval period when the land was developed (ARUP 2014).

6 Proposed development impact and recommendations

6.1 Deposits of archaeological and palaeo-environmental interest

The Lea valley floodplain sequence accumulated within the archaeological timescale and therefore potentially has archaeological value. Although the Quaternary sequence (and hence deposits of archaeological interest) are likely to extend to a depth in excess of 15m below ground level (bgl), significant thicknesses of this are floodplain and low terrace gravels. These deposits have little direct archaeological (artefact) potential but high palaeo-environmental potential (particularly within the low terrace gravels) because of the Late Pleistocene 'Arctic Bed' and 'sub Artic Bed' deposits they can contain which are of high significance and rarity. Arctic Bed deposits were logged in BH313 in the NE of the site within the ERF footprint.

In the main, however, it is the floodplain deposits that lie between the top of the Pleistocene gravels and the base of the made ground that have the highest levels of archaeological and palaeo-environmental potential. The surface of the deposits of interest is likely to vary across the site, but appear, in general, to lie between *c* 2-3m bgl and extend to a depth of 6m bgl. The main levels and facies of potential within the site have been identified as:

- Early prehistoric archaeological potential is low with the possibility of Mesolithic human activity in prehistoric soils within any remnant Pleistocene sands overlying the gravels (Facies 1 & 2) particularly upon the low terrace feature. Any archaeological evidence is likely to take the form of flint scatters, burnt materials and the like relating to temporary occupation.

- The overlying organic clay and peat deposits (Facies 3), in contrast, have a high potential for preserving a different range of ecological indicators tracking the changing prehistoric / historic environment (and indirect evidence for anthropogenic activity) particularly within the peat deposits that survive to depth across the Lea Valley. The Lea Valley is particularly rich in these deposits and data from surrounding sites indicate the early environment of the Lea particularly distinctive in comparison with that of the wider Thames catchment.

- Finally, the minerogenic deposits (Facies 4) overlying the peats will have moderate potential to preserve diatoms, molluscs and ostracods, which will provide data on the changing climate and hydrology of the floodplain as the knock on effect of sea level rise caused a change in the fluvial environment of the lower Lea and inundated the site completely. Added to this, there is moderate to low potential for artefactual remains in these deposits such as timber wharfs, jetties, boats and fish traps along historic channels that migrated across the valley unhindered until the medieval period.

On the basis of the location, extent and thickness of the various deposits identified in the deposit model and shown on the plan and transects, the site has been divided up into a number of Landscape Zones (LZs). These are shown on Fig 12 and set out in Table 1, which provides a description of the character of each LZ and also notes its likely archaeological and palaeoenvironmental potential.

Zone	Character of zone	Archaeological / palaeo-environmental potential
1	Landscape Zone 1 is located in the northern area of the site within the footprint of the ERF development where the thickest accumulations of made ground occur (6m+) coupled with areas of deep alluvial truncation. In this area however Arctic Bed deposits within the gravels have been logged in borehole records in close proximity to the Bunker area.	If the truncation is as severe as it appears, this part of the site will have very low potential for recovering anything of archaeological value or meaning however the Arctic Bed (and sub-arctic bed) deposits are of great palaeo-environmental value as they are remnants of an environment in the Lea Valley toward the end of the last Ice Age and provide rare examples of plant materials and faunal remains relating to cold climatic conditions.
2	Landscape Zone 2 is located in the northern and central area of the site particularly beneath the present EFW facility and is an area dominated by late prehistoric/historic silty clay deposits that represent alluvial deposits of the Lea as it meandered across the site. Often buried and occasionally truncated by 2-3m of made ground these former river channels have eroded the earlier peat deposits (sometimes completely) destroying earlier evidence of Mesolithic environment.	The silty clays have moderate potential to preserve microfossils such as diatoms, molluscs and ostracods which can provide data on the changing climate and hydrology the floodplain as the knock on effect of sea level rise caused a change in the fluvial environment of the lower Lea and inundated the site. Added to this, although in part truncated, there is moderate to low potential for artefactual remains such as timber wharfs, jetties, boats and fish traps along fringes of historic channels.
3	Landscape Zone 3 is located in the western, south- eastern and southern areas of the site; this zone offers the greatest potential for the recovery of untruncated peat and alluvial deposits. Here the made ground is, on average, at its thinnest but blankets the thickest deposits of silty clay and peat. It is also the complexity of the underlying stratigraphy particularly in the deeper channels in the west beside the low terrace where humic sands and colluvial deposits have accumulated buried by peats.	Early prehistoric archaeological potential is moderate with the possibility of Mesolithic human activity in prehistoric soils underlying the peats particularly in proximity to the deeper channel areas. Any archaeological evidence is likely to take the form of materials relating to temporary occupation. The peat and overlying silty clay deposits have high potential for preserving a different range of proxy-environmental indicators (and material for radiocarbon dating) for tracking the changing prehistoric / historic environment over time. Furthermore, there is moderate potential for artefactual remains in particularly in the peat deposits such as branch-lain trackways constructed in the prehistoric to access the rivers resources.

Table 1: Landscape Zones within the site and their archaeological / palaeoenvironmental potential

6.2 Impact of the development

The proposed foundation slab level of the ERF facility (within LZ1) will be at c 12.5m AOD (see Fig 11). The depth of the slab has yet to be confirmed but it is not expected to be more

than c 1 to 2m in thickness. Given the thickness of the made ground across this part of the site the slab foundations are not expected to impact on the underlying alluvial deposits. The excavations for the Bunker Facility within the ERF complex will extend to c 10m bgl and will therefore entirely remove any alluvial deposits within its footprint. In addition to this the ERF facility is expected to be built on piled foundations, the design and layout of which has yet to be determined. The piling will impact locally on any surviving floodplain deposits.

Of particular note are the Arctic Bed deposits within the low terrace gravels that are rarely exposed but do exist on the site as noted in BH313 within the ERF footprint. These deposits do occur at depth (*c*. 6m bgl) and lie well beneath the slab foundation levels. However, there is a fairly high probability that these deposits will be encountered during the excavations for the Bunker and during piling.

The central area of the site (LZ2) is dominated by the current EFW complex and therefore is not affected by the current works although later demolition work could disturb deposits of archaeological interest.

The construction of the RRF and the Reception Building on the southern area of the site lies across the area of greatest archaeological potential (LZ3). The slab level for the RRF building will be at c 10.70m AOD. However, in the central part of the building the ground will be reduced by c 1m with a slab level of c 9.70m AOD. The thickness of the slab has yet to be confirmed, but assuming that the slab will be c 1 to 2m in thickness the excavations for these foundations may impact on the upper part of the floodplain sequence. These deposits are likely to consist of overbank flood deposits (i.e Facies 4) and are therefore of relatively low archaeological and palaeoenvironmental potential. Piling is indicated on the design proposal drawings (see Fig 11) and these piles will impact locally on the deeper part of the alluvial sequence.

The foundation slab for the Reception Building has a proposed level of c 10.40m AOD. The depth of the slab has yet to be confirmed. However, excavations for the new slab may impact on the upper floodplain sequence, which is likely to consist of overbank floodplain deposits. These deposits, as stated above, are likely to be of low archaeological and palaeoenvironmental potential. Piling is also proposed for this structure, and this will impact locally on the deeper part of the alluvial sequence. The exact piling layout for the Reception Building has yet to be confirmed.

6.3 Recommendations

The borehole and window sample data has allowed an assessment to be made on the deposit sequence likely to be encountered on the site. The interpretation and chronology assigned to the deposit sequence has been aided by previous work undertaken on nearby sites. The extent and characteristics of the palaeo-environments identified within this report may change with further geotechnical or geoarchaeological data. Other significant landscape features not identified within this current model may also come to light.

Based on the above conclusions, it is recommended that a targeted borehole survey is undertaken to mitigate the impact on the alluvial sequence from the proposed piling. The positioning of the boreholes should consider the size and layout of the proposed piles. In particular, the borehole survey should focus on the area of the ERF facility where the Arctic Bed deposits are expected to occur. Any borehole core samples obtained from such an exercise can be examined off site to ascertain the potential of the sediments to contain palaeoenvironmental proxy indicators that can be used to reconstruct past environments.

Information from these cores may therefore be used to understand the depositional history and floodplain development of this part of the Lea Valley.

The excavations for the slab foundations are only likely to impact on the upper alluvial deposits on the southern part of the site within the area of the proposed RRF and Reception Building. Consideration should therefore be given to undertaking a geoarchaeological watching brief on these areas. The Bunker within the ERF complex constitutes the single largest impact on the alluvial deposits. However, the deposit model has suggested that large portions of the floodplain sequence have been truncated within this area. In light of this a geoarchaeological watching brief on the excavations for the Bunker could be considered the appropriate level of mitigation. The gravel deposits within this area have the potential to contain the Arctic Beds.

Once the development proposals have been finalised and the impact on deposits of archaeological and/or geoarchaeological potential has been fully determined an appropriate scope of archaeological mitigation should be decided in consultation with the client and the GLAAS regional advisor.

7 Bibliography

ARUP, 2014 North London Waste Authority North London Heat and Power Project, Archaeological desk based assessment. Unpublished Client Report

Bates, MR and Whittaker, K, 2004 'Landscape evolution in the Lower Thames Valley: implications for the archaeology of the earlier Holocene period' in Towards a New Stone age: aspects of the Neolithic in south–east England CBA Research Report 134, edited by Jonathon Cotton and David Field

BGS Solid and Drift Sheet 256 (North London)

Collins, PEF, Fenwick, IM, Keith–Lucas, DM, and Worsley, P, 1996 'Late Devensian river and floodplain dynamics and related environmental change in northwest Europe, with particular reference to a site at Woolhampton, Berkshire, England', Journal of Quaternary Science 11, 257–375

Corcoran, J., Halsey, C., Spurr, G., Burton, E. and Jamieson, D. 2011 Mapping past landscapes in the lower Lea valley: A geoarchaeological study of the Quaternary sequence. Museum of London Archaeology, MOLA Monograph 55.

English Heritage, 2002, Environmental Archaeology: a guide to the theory and practice of methods, from sampling and recovery to post–excavation

English Heritage, 2004, Geoarchaeology: using earth sciences to understand the archaeological record

Evans, J.G., and Smith, I.F., 1983. Excavations at Cherhill, north Wiltshire, 1967. Proceedings of the Prehistoric Society, 49, pp. 43-117.

Gibbard, P.L. 1994 The Pleistocene history of the Lower Thames Valley. University Press: Cambridge. 229pp.

Ground Technology, 2011 Phase 2 Edmonton Ecopark. Geotechnical site investigation records.

Ground Technology, 2014 Edmonton Ecopark. Geotechnical site investigation records.

Hayward, J.F., 1956 Certain abandoned channels of Pleistocene and Holocene Age in the Lea Valley, and their deposits Proc Geol Ass 67, 32-63

Howard, AJ and Macklin, MG, 1999 'A generic geomorphological approach to archaeological interpretation and prospection in British river valleys: a guide for archaeologists investigating Holocene landscapes' Antiquity 73, 527–541

Humphrey, R., Melikian, M 2008 The IKEA site, Glover Drive, Edmonton: Archive Report. AOC Twickenham: AOC Archaeology

Institute of Field Archaeologists (IFA), rev. 2001 By–Laws, Standards and Policy Statements of the Institute of Field Archaeologists, Standard and guidance: Desk Based Assessment

Grant, M.J., Stevens, C.J., Whitehouse, N.J., Norcott, D.N., Macphail, R.I., Langdon, C., Cameron, N., Barnett, C., Langdon, P.G., Crowther, J., Mulhall, N., Attree, K., Leivers, M.,

Greatorex, R. and Ellis, C. (2014) A palaeoenvironmental context for Terminal Upper Palaeolithic and Mesolithic activity in the Colne Valley: Offsite records contemporary with occupation at Three Ways Wharf, Uxbridge. Environmental Archaeology, 19, (2), 131-152

Long, AJ, Scaife, RG and Edwards, RJ, 2000 'Stratigraphic architecture, relative sea level and models of estuary development in southern England: new data from Southampton Water in Coastal and Estuarine Environments: sedimentology, geomorphology and geoarchaeology Eds Pye and Allen (Geological Society Special Publication no 175), 253–281

May Guerney Professional Services, 2011 London Waste Ecopark Edmonton. Geotechnical site investigation records.

NWLA North London Heat and Power Project 2014, Consultation Booklet

OAS, 2010 Deepham's Sewage Works, Edmonton, Greater London. Updated Geoarchaeological deposit model. Unpublished Client Report

OAS, 2012 Deepham's Sewage Treatment Works, Edmonton, London. Archaeological Watching Brief Report. Unpublished Client Report

Powell, A, 2012, By River, Fields and Factories: The Making of the Lower Lea Valley Archaeological and cultural heritage investigations on the site of the London 2012 Olympic and Paralympic Games. Archaeology Mongogr. 29, Wessex and the Olympic Delivery Authority

Renfrew, C, and Bahn, P, 2012 Archaeology: Theories, Methods and Practice. Thames and Hudson.

Rose, J, 1995 'Late Glacail and Early Holocene river activity in lowland Britain', Palaeoclimate Research 14, 51–74

Spurr, G. 2006 Omega III Works London E3 : a geoarchaeological report, unpub Mola rep.

Spurr, G.,2007 The Ikea site, Glover Drive, Edmonton, London N18, a geoarchaeological report, unpub Mola rep.

Stafford, E Goodburn D and Bates M, Landscape and prehistory of the East London Wetlands: Investigations along the A13 DBFO roadscheme, Tower Hamlets, Newham and Barking and Dagenham, 2000-2003, Oxford Archaeology Monograph No. 17

Warren, S.H, 1912 On a Late Glacial stage in the valley of the River Lea, subsequent to the epoch of river-drift man. Quart J Geol Soc 68, 213-51

Wilkinson, KN and Sidell, EJ, 2000 'Late Glacial and Holocene development of the London Thames' Chapter 7 in The Holocene evolution of the London Thames (Sidell et al) MoLAS Monograph 5

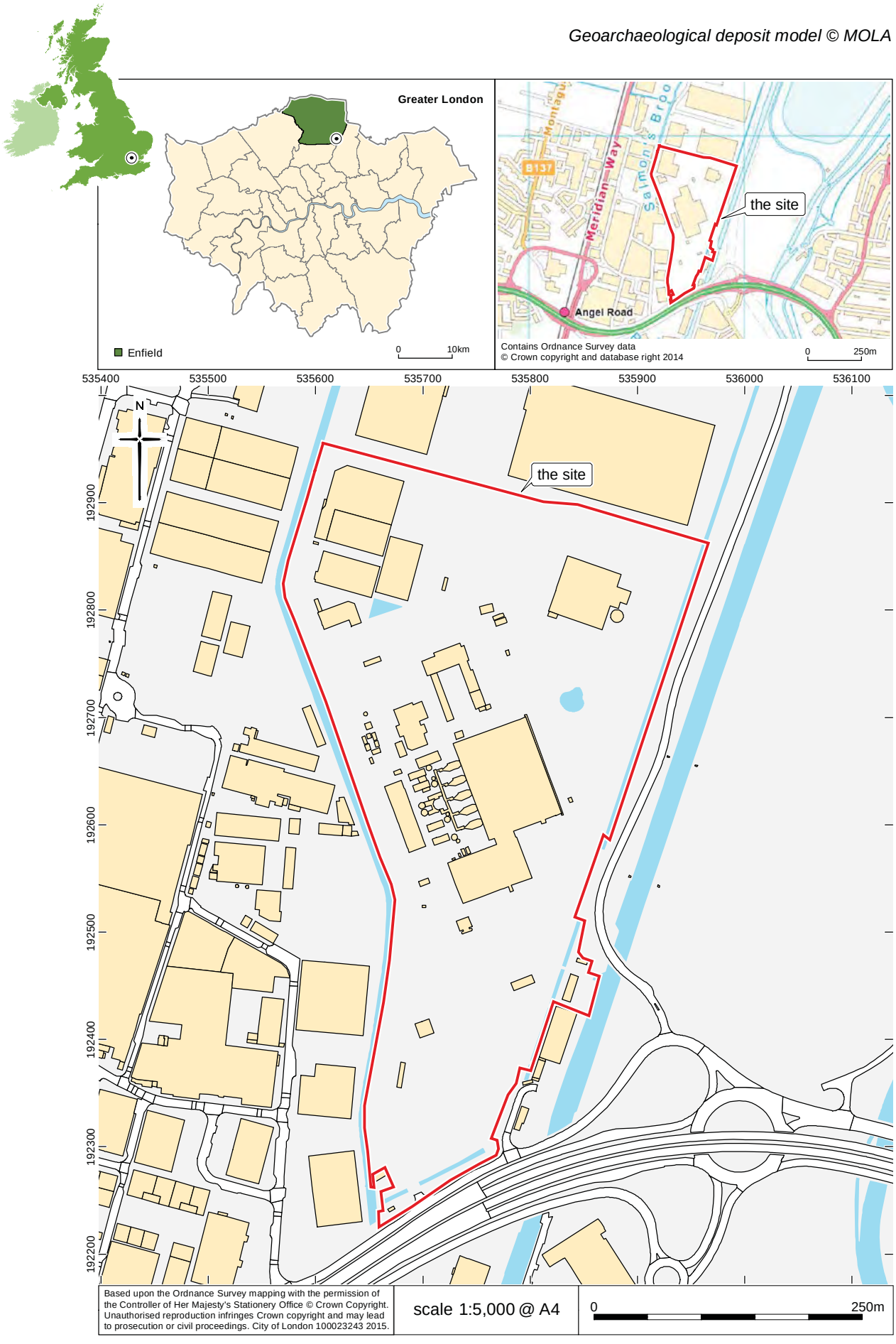

Fig 1 Site location

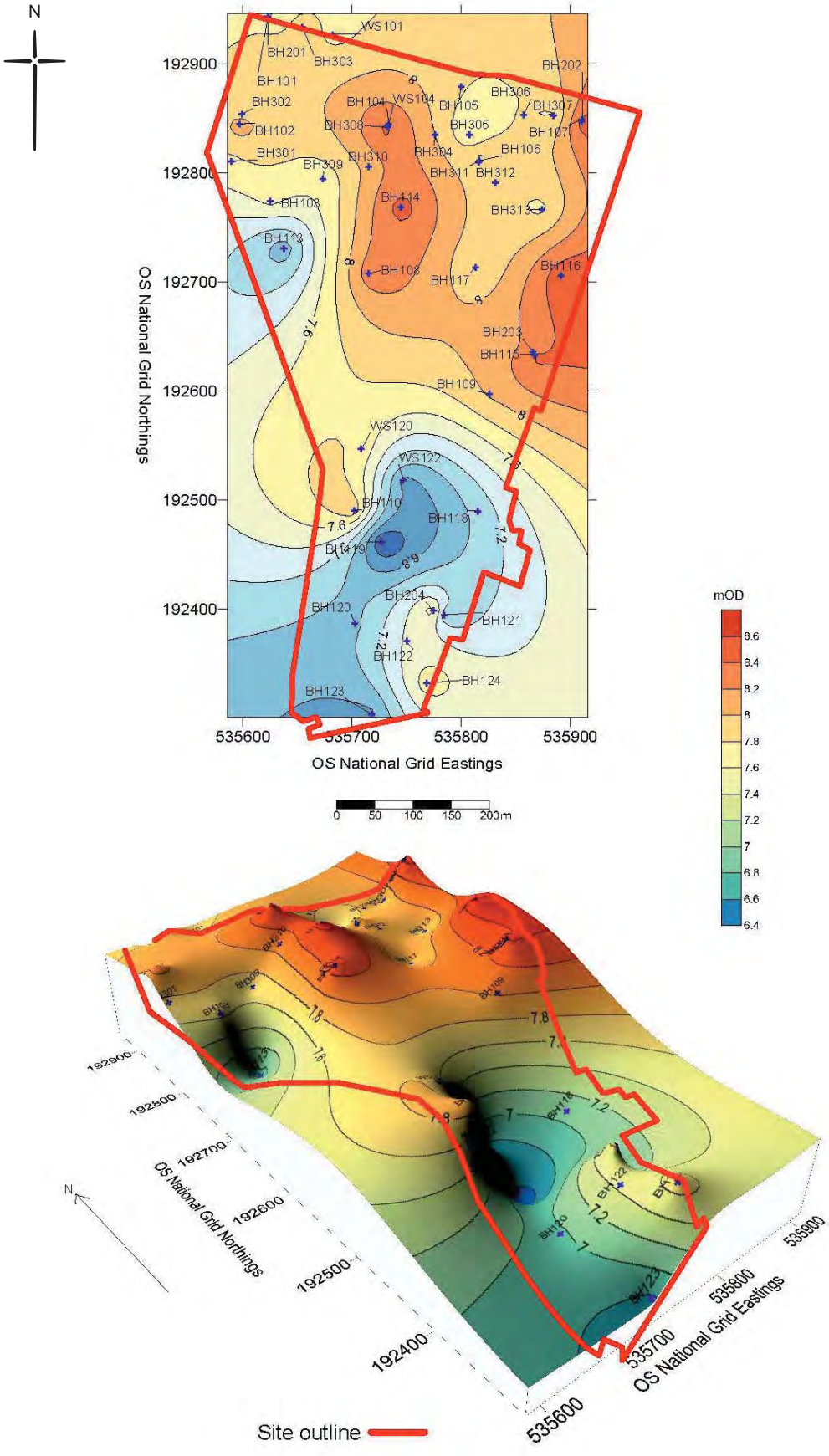

Fig 2 2D and 3D early Holocene plots representing the ancient (Mesolithic) land surface at around 10,000 BC

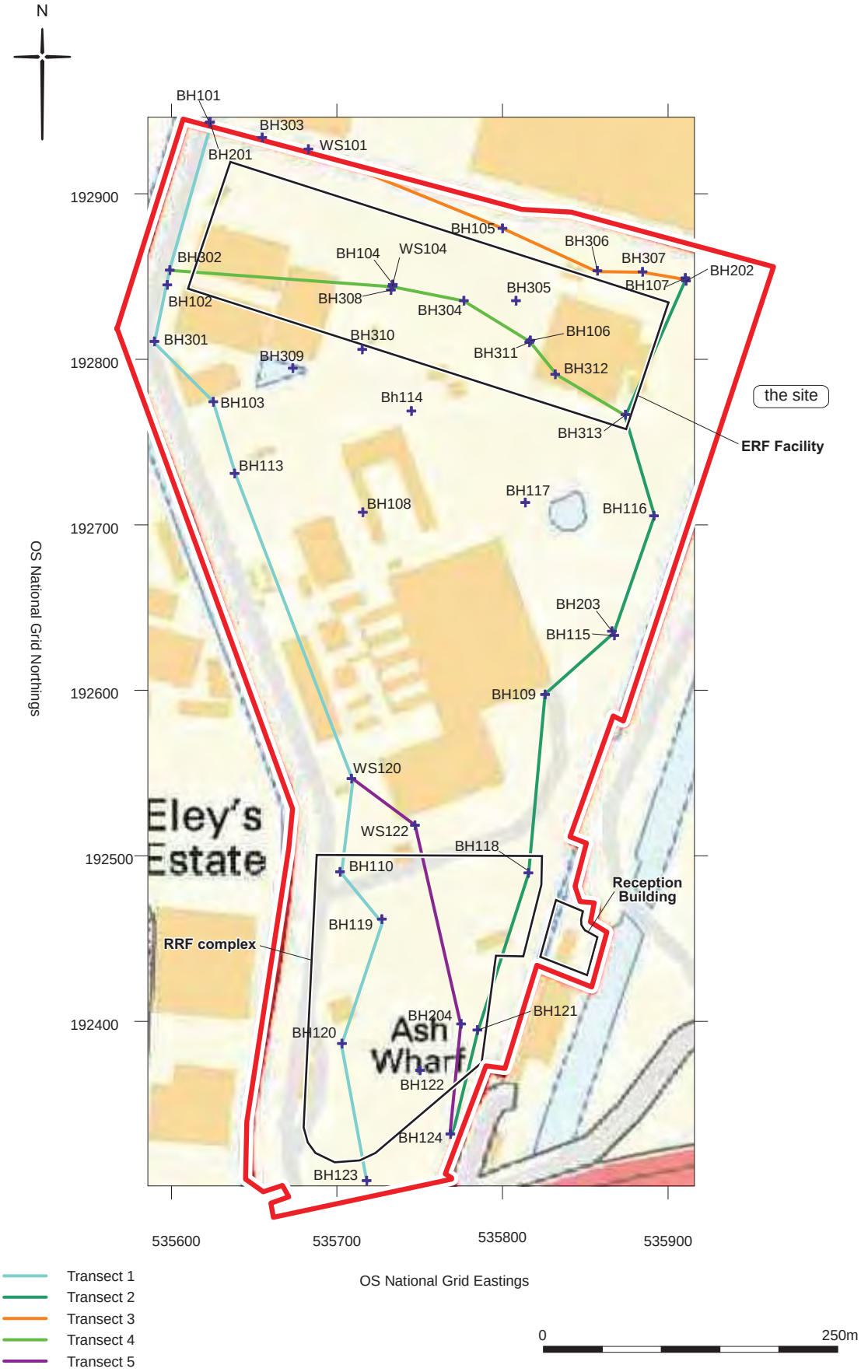

Fig 3 Site area with data points, transect and proposed development locations

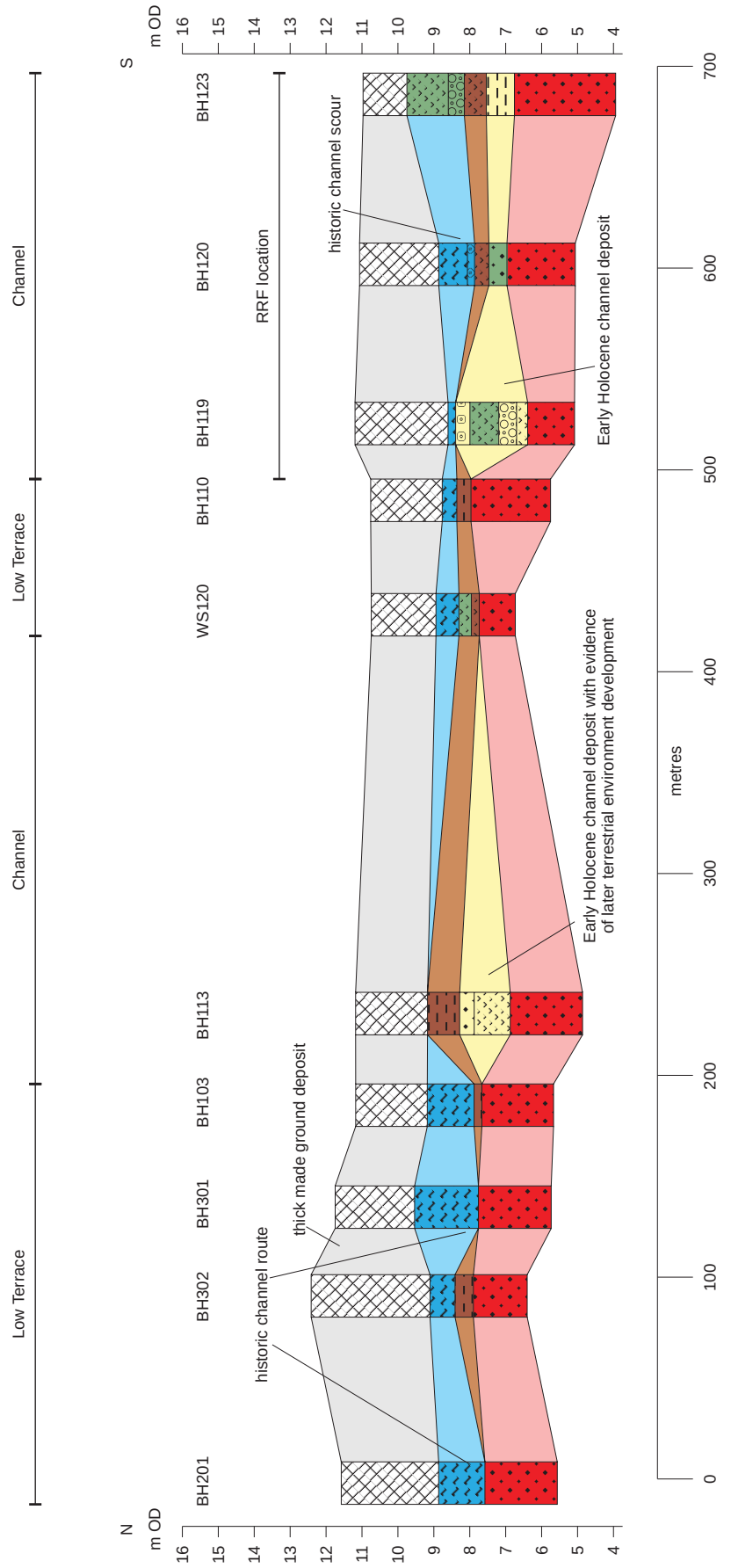

Fig 4 Transect 1 north to south along the western boundary of the site

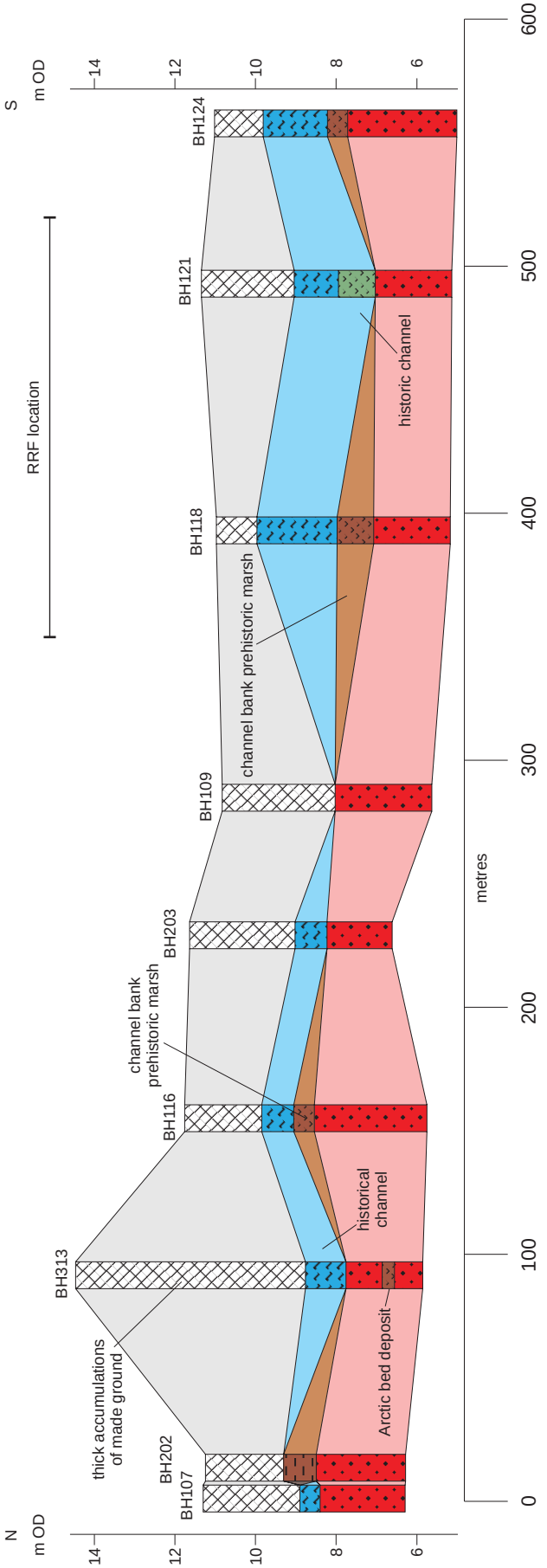

Fig 5 Transect 2 north to south along the eastern boundary of the site

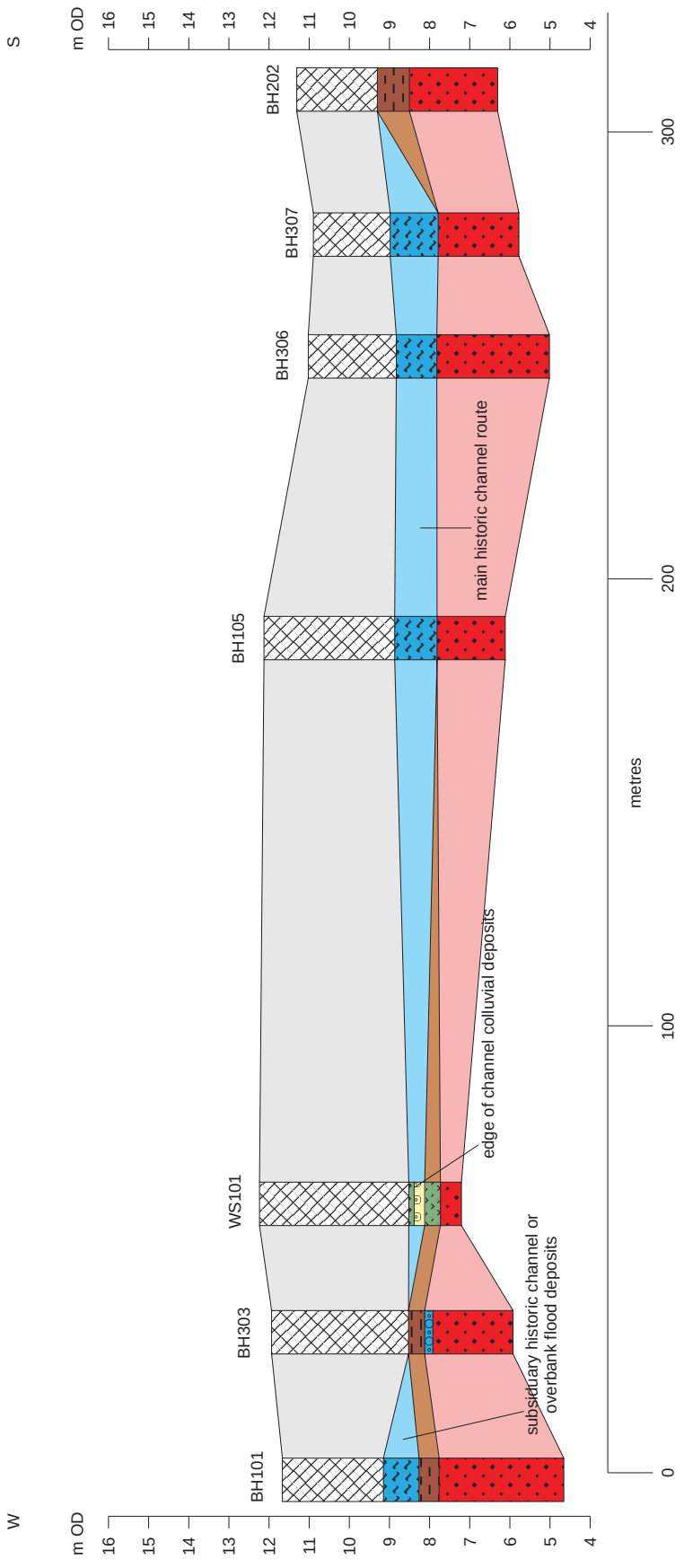

Fig 6 Transect 3 west to east across the northern boundary of the site

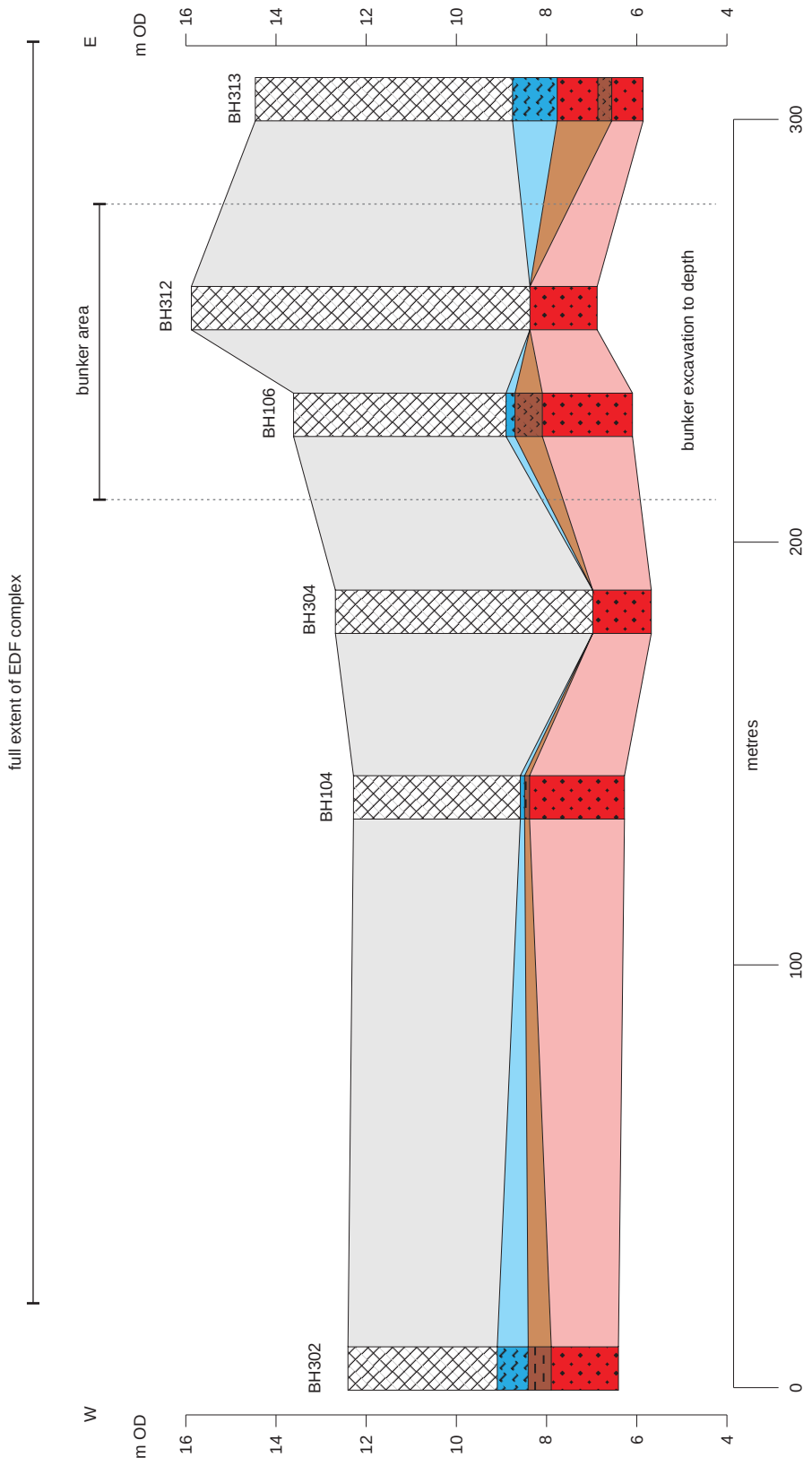

Fig 7 Transect 4 west to east across the central northern area of the site

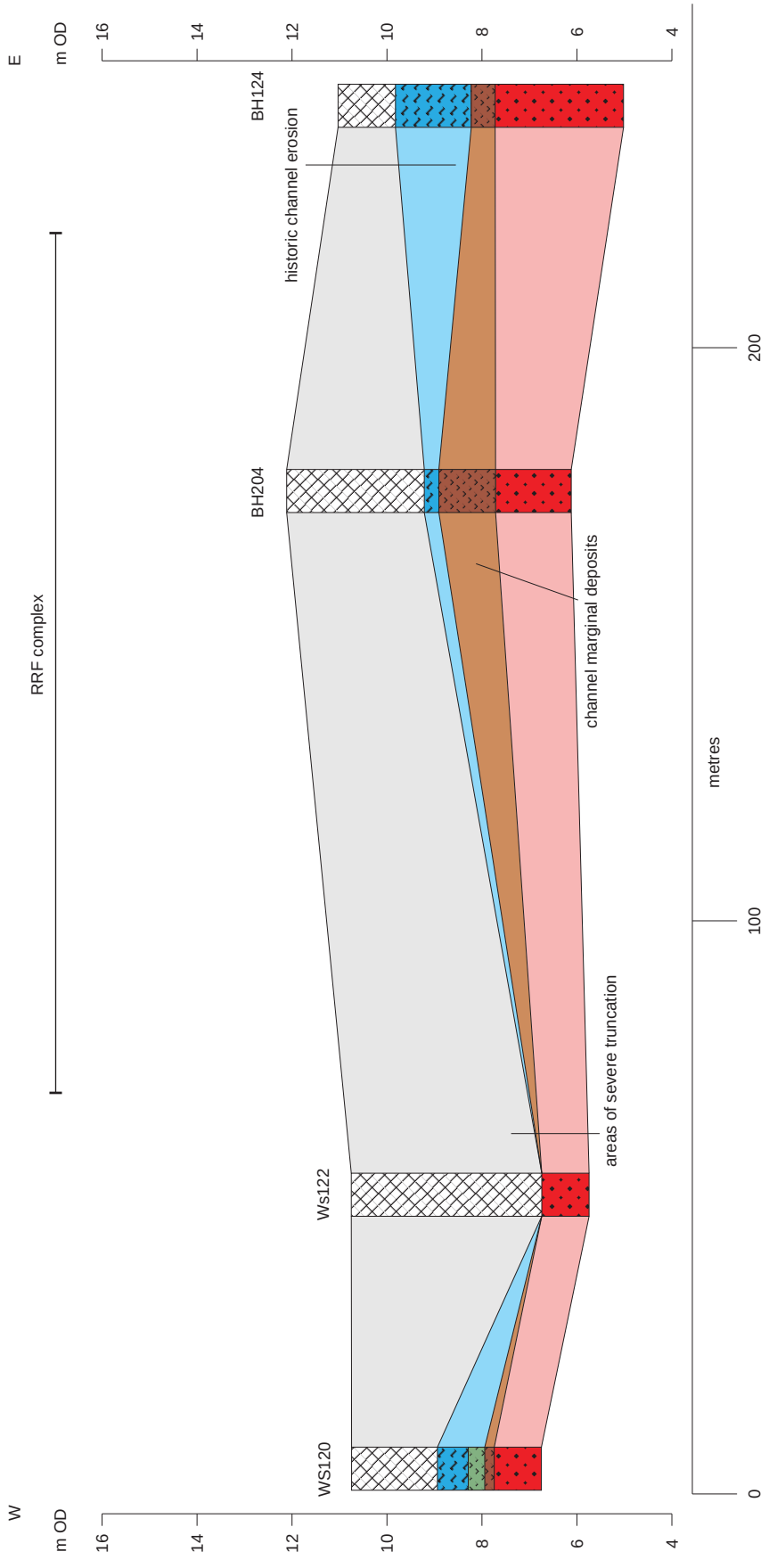

Fig 8 Transect 5 northwest to southeast across the southern area of the site

Fig 9 Key to Lithological units and Facies types

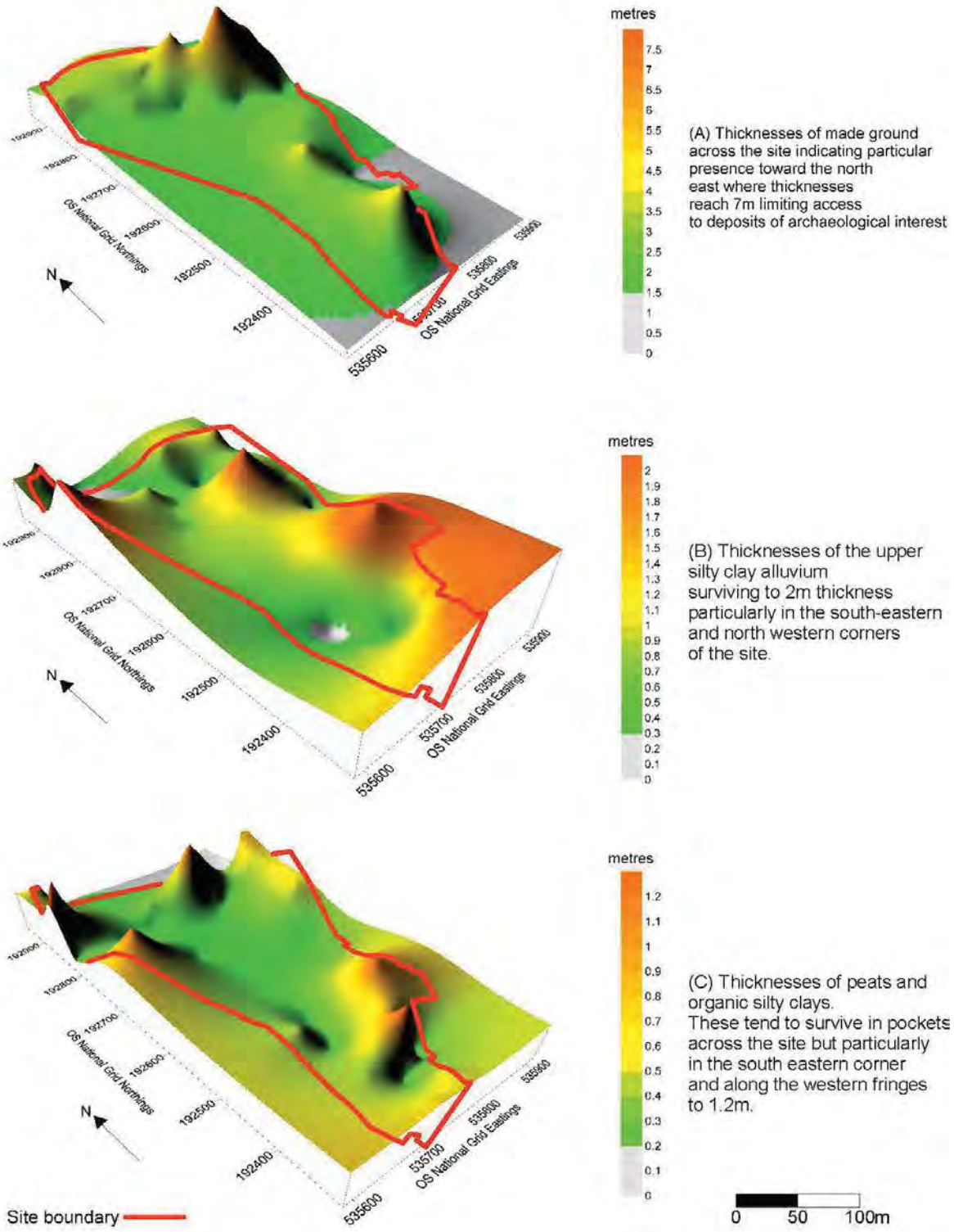

Fig 10 3D heat maps showing thicknesses of different facies across the site

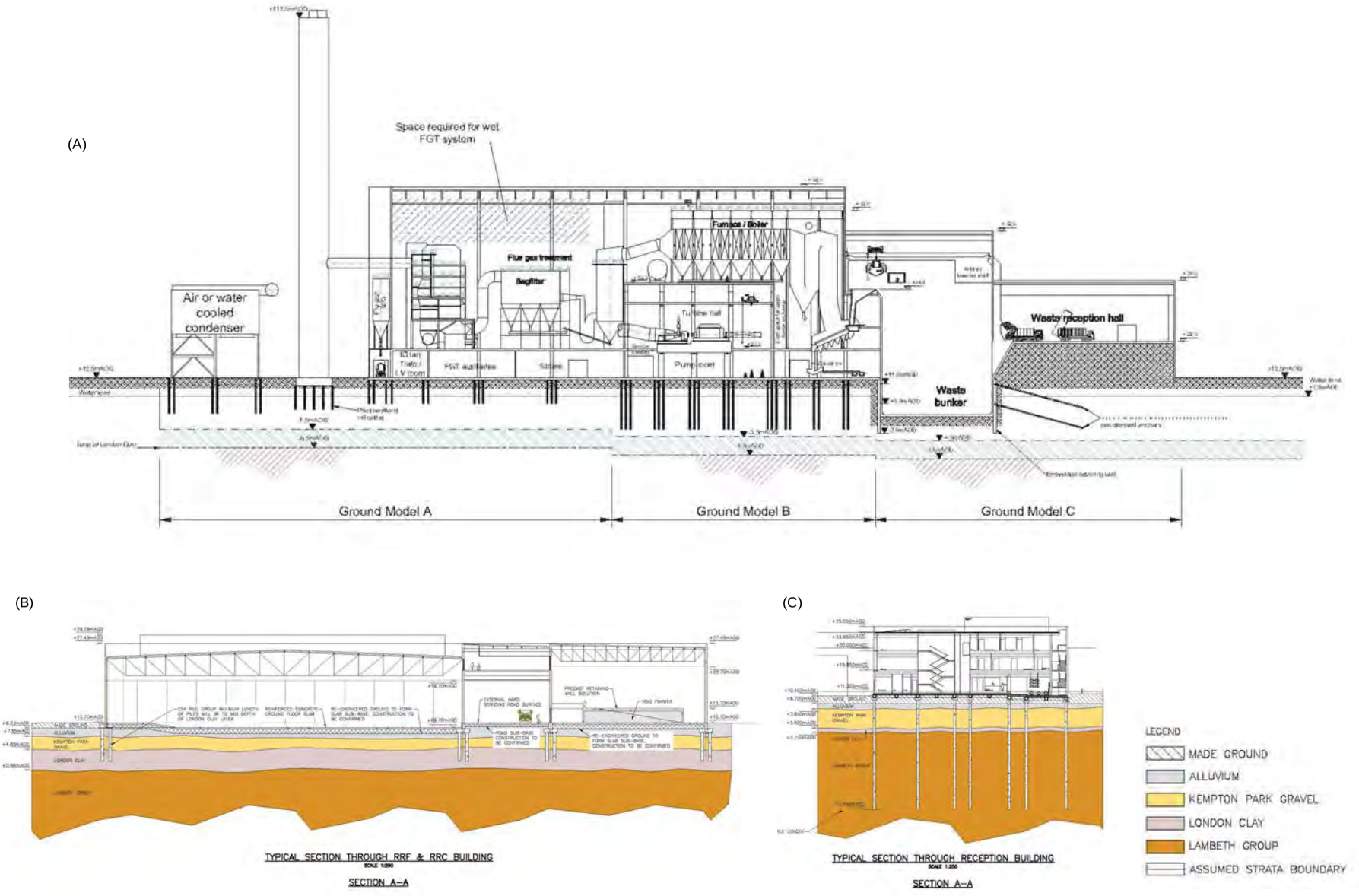

Fig 11 Cross sections through provisional design of new buildings. (A) ERF complex, (B) RRF and RRC buildings and (C) Reception Building

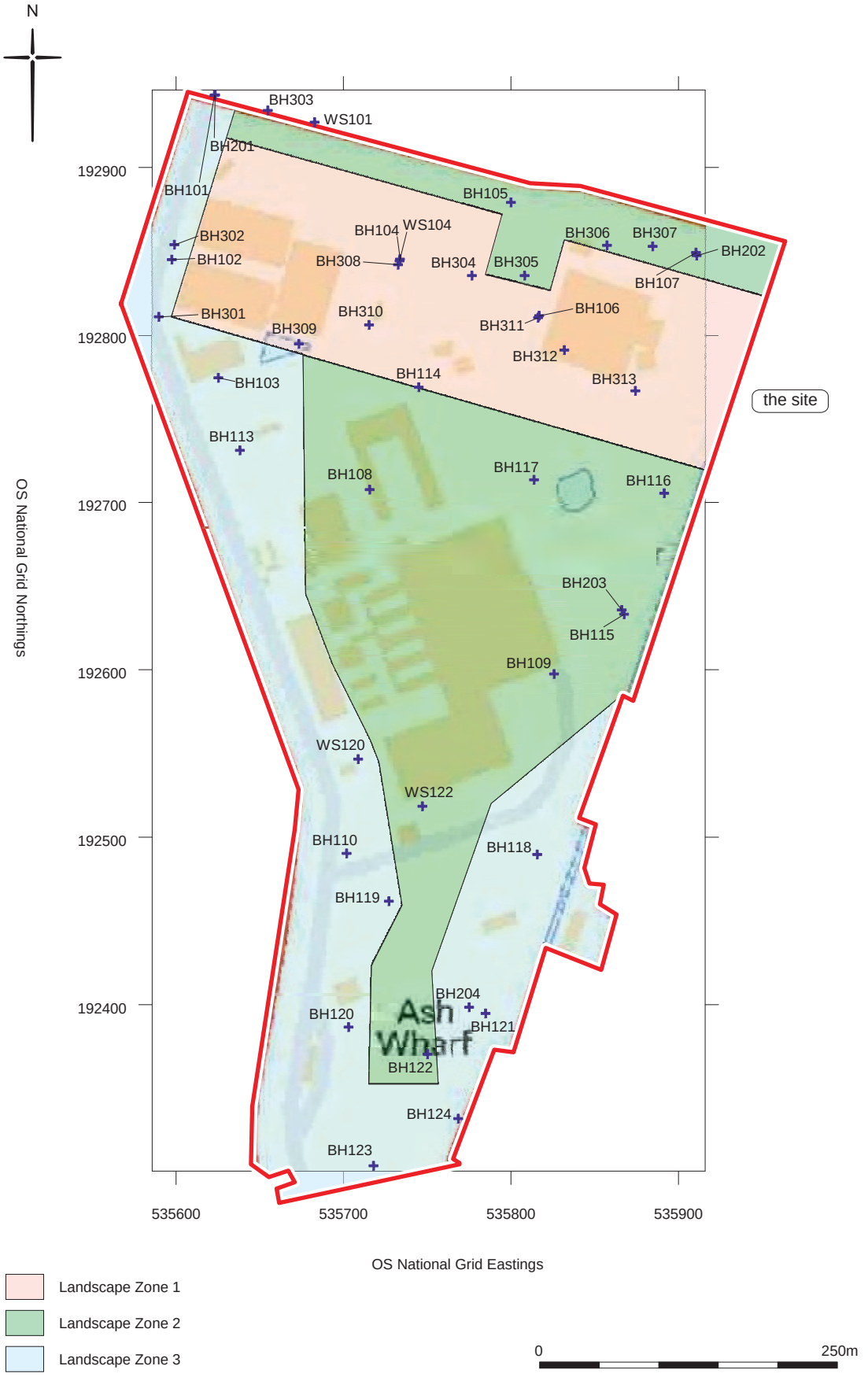

Fig 12 Landscape Zones

Series 06 Environmental Statement

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