

Lower Thames Crossing

6.3 Environmental Statement Appendices

Appendix 6.9 - Draft Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (Clean version)

APFP Regulation 5(2)(a)

Infrastructure Planning (Applications:
Prescribed Forms and Procedure) Regulations
2009

Volume 6

DATE: December 2023
DEADLINE: 8

Planning Inspectorate Scheme Ref: TR010032
Application Document Ref: TR010032/APP/6.3

VERSION: 5.0

Revision history

Version	Date	Submitted at
1.0	31 October 2022	DCO Application
2.0	03 October 2023	Deadline 5
3.0	31 October 2023	Deadline 6
4.0	17 November 2023	Deadline 7
5.0	05 December 2023	Deadline 8

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6.3 Environmental Statement Appendices Appendix 6.9 - Draft Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (Clean version)

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1 Executive summary

- 1.1.1 The Draft Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (dAMS-OWSI) sets out the essential mitigation for Heritage Assets identified within Chapter 6: Cultural Heritage.
- 1.1.2 Heritage Assets can be affected as follows:
- a. Physical impacts to designated heritage assets during the construction phase
 - b. Physical impacts to non-designated near-surface archaeological remains and palaeoenvironmental deposits during the construction phase
 - c. Physical impacts to non-designated deeply buried archaeological remains and palaeoenvironmental deposits during the construction phase
 - d. Physical impacts to built heritage, both designated and non-designated, during the construction phase
 - e. Indirect impacts to the setting of designated and non-designated heritage assets, comprising archaeological remains, historic buildings and historic landscapes
- 1.1.3 The dAMS-OWSI, and the approach to cultural heritage mitigation across the Project has been to avoid any Heritage Assets where possible or if this is not possible to protect the Heritage Asset from damage, for example through fencing. However, for the majority of buried archaeological remains affected by the Project, including the Scheduled Cropmark Complex at Orsett (Heritage Asset SM1) this has not been possible, and the established method of mitigation is archaeological investigation and recording. Archaeological excavation, recording the results and using them to “*advance understanding of the significance of the heritage asset before it is lost (wholly or in part)*” (National Policy Statement for National Networks (NPSNN) para 5.140).
- 1.1.4 The Project has identified 369 archaeological sites, 11 historic buildings, including three Grade II listed buildings (LB58, Thatched Cottage; LB 89, 1 and 2 Grays Corner Cottage and LB96, Murrells Cottages that require investigation and recording and three historic landscape types.
- 1.1.5 The dAMS-OWSI contains appropriate essential mitigation measures for both archaeological remains and built heritage affected by the Project. The dAMS-OWSI has been produced for Development Consent Order submission, although in line with standard practice, during the DCO examination period the document will be updated to address stakeholder requests, so that a finalised document would be agreed by the time that a DCO is granted.
- 1.1.6 The dAMS-OWSI describes the roles of the various bodies involved in the delivery of the mitigation programme, these include the National Highways Historic Environment Manager, the Main Works Contractors, the Archaeological Contractors and the Local Authority Archaeological Advisors who advise the Local Planning Authorities. The dAMS-OWSI provides further details about the

role each party plays in the event of an unexpected discovery and the eventual sign-off of each area of archaeological mitigation.

- 1.1.7 The dAMS-OWSI sets out which Heritage Assets will be affected in each construction zone and provides a proposed mitigation technique for each Heritage Asset.
- 1.1.8 The dAMS-OWSI sets out the scope, guiding principles and methods for the planning and implementation of essential cultural heritage mitigation across the Project. In line with Schedule 2, Requirement 9 of the draft Development Consent Order (Application Document 3.1), a Site Specific WSI (SSWSI) will be prepared by the archaeological contractors that sets out the detailed methodology for each area of fieldwork.
- 1.1.9 The dAMS-OWSI provides a summary of over 4000 archaeological trial trenches carried out as part of the assessment for the Project and describes the Research Agenda that will frame questions which will guide the objectives of the individual SSWSIs. Chapter 7 of the dAMS-OWSI provides a generic methodology for each fieldwork technique to be used on the Project and Chapter 8 details the requirement for post excavation analysis and the eventual publication of the archaeological and other heritage work arising from the mitigation programme.
- 1.1.10 Finally, the dAMS-OWSI presents a Public Archaeology and Community Engagement Strategy in Annex A.

2 Introduction

2.1.1 This document provides a Draft Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (dAMS-OWSI) for the A122 Lower Thames Crossing (the Project), to support the Environmental Statement (ES) submitted as part of the Development Consent Order (DCO) application.

2.1.2 Throughout this document, references are made to the ES [Document References 6.1, 6.2 and 6.3]. This has been updated, and should be read with reference to the latest version of the ES Addendum [Document Reference 9.8].

2.2 The Project

2.2.1 The Project would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing under the River Thames through a tunnel. The Project route is presented in Plate 2.1.

2.2.2 The A122 would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13, M25 junction 29 and the M25 south of junction 29. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

2.2.3 Junctions are proposed at the following locations:

- a. New junction with the A2 to the south-east of Gravesend
- b. Modified junction with the A13/A1089 in Thurrock
- c. New junction with the M25 between junctions 29 and 30

2.2.4 To align with National Policy Statement for National Networks (Department for Transport, 2014) policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied in line with the Dartford Crossing. Vehicles would be charged for using the new tunnel.

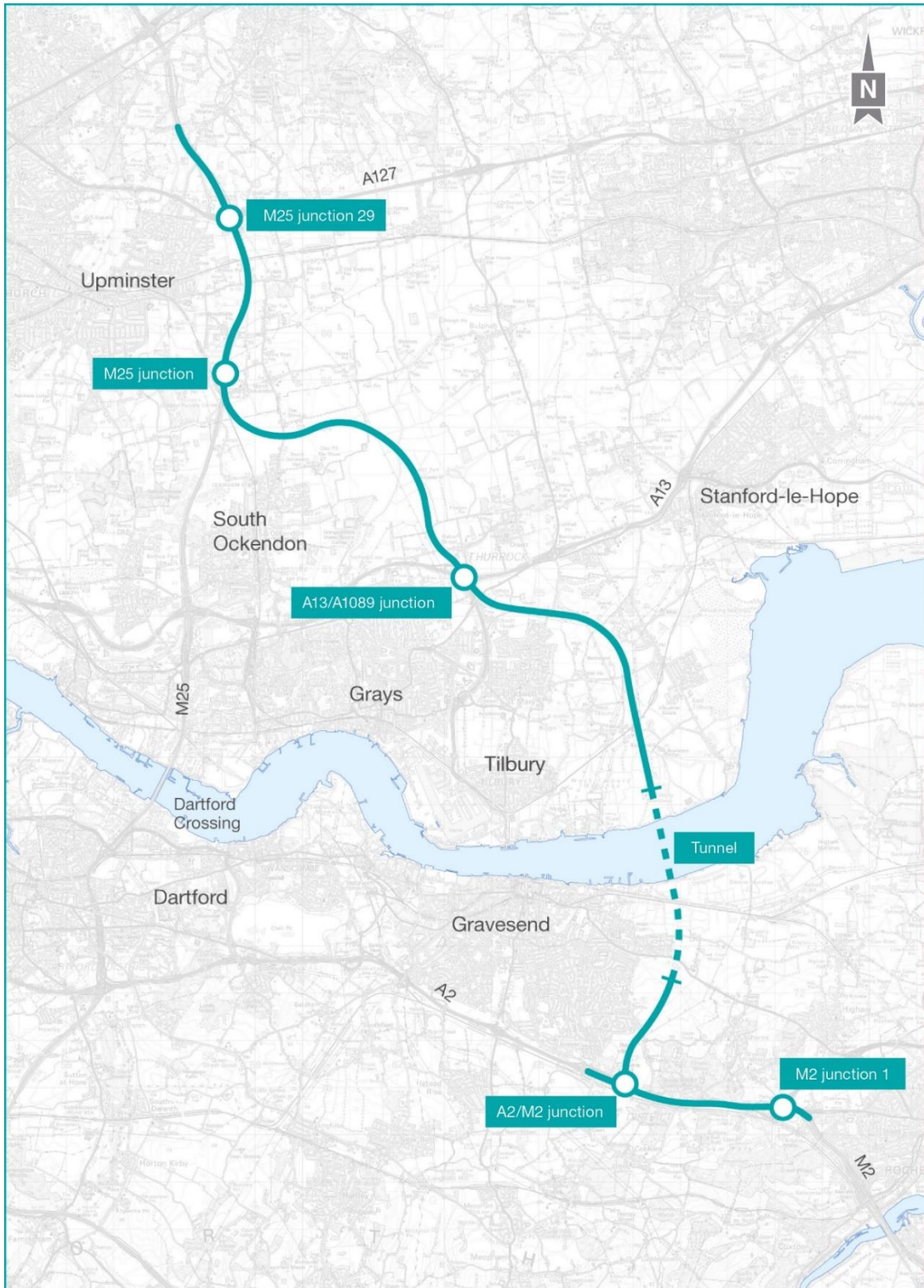
2.2.5 The Project route would be three lanes in both directions, except for:

- a. link roads
- b. stretches of the carriageway through junctions
- c. the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes

2.2.6 In common with most A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. The A122 design outside the tunnel would include emergency areas. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

- 2.2.7 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For safety reasons, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.
- 2.2.8 The Project would include adjustment to a number of local roads. There would also be changes to a number of Public Rights of Way, used by walkers, cyclists and horse riders. Construction of the Project would also require the installation and diversion of a number of utilities, including gas pipelines, overhead electricity powerlines and underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.
- 2.2.9 The Project has been developed to avoid or minimise significant effects on the environment. The measures adopted include landscaping, noise mitigation, green bridges, floodplain compensation, new areas of ecological habitat and two new parks.

Plate 2.1 Lower Thames Crossing route



2.3 Status of the dAMS-OWSI

2.3.1 This dAMS-OWSI is submitted as a draft which will be refined before the Examination and during the Examination, in consultation with key heritage stakeholders including the Local Planning Authorities and their archaeological and historic buildings advisors and Historic England. Other discussions will

continue over the programming of the various elements of the Project to ensure archaeological mitigation is appropriately resourced and sufficient time allowed. After this it will be known as the AMS-OWSI.

- 2.3.2 After consultation with the key stakeholders Annex B will be prepared that will set out each grouping of Heritage Assets detailing the relevant archaeological baseline and rationale for mitigation. For those areas where archaeological investigation and recording is proposed relevant research themes and period-based questions will be presented.

2.4 Purpose of the dAMS-OWSI

- 2.4.1 The purpose of this document is to set out the scope, guiding principles and methods for the planning and implementation of essential archaeological mitigation works associated with the design and construction of the Project. For the purposes of this dAMS-OWSI archaeological mitigation works includes mitigation on historic buildings and historic landscapes. It follows the approach to mitigation provided for in Requirement 9 of Schedule 2 of the Draft Development Consent Order (Application Document 3.1) and as set out in ES Chapter 6: Cultural Heritage (Application Document 6.1) and item CH001 of the Register of Environmental Actions and Commitments (REAC) within the Code of Construction Practice, First iteration of Environmental Management Plan, (Application Document 6.3, ES Appendix 2.2). This document details the archaeological mitigation proposed to reduce the effect of the Project on archaeological remains, historic buildings and historic landscapes.
- 2.4.2 The first principle of archaeological mitigation is to preserve or protect archaeological remains wherever possible or, where this is not possible, to implement a structured programme of archaeological investigation and recording.
- 2.4.3 Although all archaeological evaluation necessary for the purposes of the ES was completed additional archaeological evaluation will also be carried out at certain locations along the Project where access was previously not possible or where only a limited amount of work was carried out. The purpose of this will be to inform the detailed mitigation requirements.
- 2.4.4 This document presents the approach to consultation and approvals, project management, and the post-excavation analysis and publication stages.
- 2.4.5 This document summarises the archaeological trial trenching (ATT) and describes the proposed mitigation works and methods that will be implemented, based on the results of previous archaeological surveys and trial trenching associated with the Project.

2.5 Scope of the dAMS-OWSI

- 2.5.1 The dAMS-OWSI sets out the framework for archaeological mitigation of sites affected by the Project. This document conforms with current good practice and takes account of guidance.

- 2.5.2 In line with guidance in DMRB LA 106 the mitigation measures proposed within this dAMS-OWSI include:
- a. avoidance, preservation by burial, or investigation in the case of archaeological remains
 - b. recording, photographic or drawn to scale surveys in the case of historic buildings
 - c. recording, information panels or landscape works in the case of impacts on historic landscapes
 - d. reduction to impact on setting through screening or landscaping
- 2.5.3 The embedded and good practice mitigation measures relevant to cultural heritage are described in Chapter 6: Cultural Heritage, section 6.5, paragraph 6.5.6 – 6.5.15.
- 2.5.4 Essential mitigation measures specific to cultural heritage are secured through the REAC within the Code of Construction Practice, First iteration of Environmental Management Plan (Application Document 6.3, Appendix 2.2) and is consistent with Requirement 9 of the Draft Development Consent Order (Application Document 3.1) These comprise:
- a. REAC Ref CH001 provides for the production of the AMS-OWSI
 - b. REAC Ref Ch002 ensures that land taken for archaeological investigations does not extend beyond the limits of deviation of the Project
 - c. REAC Ref CH003 ensures that a detailed project design for the archaeological investigation of the cropmark complex at Orsett (SM1) is prepared in line with the Management of Research Projects in the Historic Environment (MoRPHE) procedural model (Historic England, 2015)
 - d. REAC Ref CH004 ensures that a Level 4 Historic Building Recording (Understanding Historic Buildings: A Guide to Good Recording Practice (Historic England, 2016) of the three listed buildings at 1 and 2 Grays Corner (LB89), Thatched Cottage (LB58) and Murrells Cottage (LB96) is carried out, and that the relevant archaeological contractor shall apply to Historic England for removal of the three buildings from the official list of protected historic sites
 - e. REAC Ref CH005 ensures the protective fencing of heritage assets
 - f. REAC Ref CH006 ensures the burial of potentially sensitive archaeological remains beneath fill material to ensure they are not disturbed during construction
 - g. REAC Ref CH007 ensures that SSWSIs shall set out the arrangements and responsibilities for implementing, monitoring and auditing the mitigation measures identified in the SSWSIs

- h. REAC Ref CH008 ensures that Cultural Heritage Asset Management Plans would be implemented by National Highways in accordance with DMRB LA 116 Cultural heritage asset management plans, (Highways England, 2019b). for any heritage assets that remain within its ownership following construction of the Project
- i. REAC Ref CH009 ensures that a two stage approach, including deep 10m x 10m test pits, is taken for the mitigation of deeper Palaeolithic and Holocene deposits.
- j. REAC Ref CH010 ensures that Local Authority Archaeological and Historic Buildings Advisors have access to the Project to monitor and sign-off relevant work.

2.5.5 Consistent with Requirement 9 of the Draft Development Consent Order (Application Document 3.1) the individual Site Specific Written Schemes of Investigation (SSWSIs) will be prepared by the relevant Archaeological Contractor(s) and approved by the Secretary of State following consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors) and Historic England.

2.5.6 Each SSWSI will be approved prior to the fieldwork referred to within that SSWSI commencing.

2.5.7 The majority of the cultural heritage assets identified are terrestrial in nature. This does not preclude mitigation works within the non-terrestrial environment, for example Asset 412 extends across the inter-tidal zone on the north bank of the River Thames. All works that have the potential to impact on cultural heritage assets will require an SSWSI, which will be carried out to the relevant standards, including where appropriate guidance on marine archaeology. The Port of London Authority will be consulted on any SSWSI with a marine, tidal or inter-tidal component.

2.6 Roles and responsibilities

2.6.1 **Main Works Contractors(s).** The Project will be delivered across three separate contracts, Kent Roads, Tunnels and Roads North, each with their own Main Works Contractor.

2.6.2 **Archaeological Contractors.** These will be appointed by each Main Works Contractor who will be responsible for the delivery of the archaeological mitigation programme as set out in this document. This responsibility will include all on-site and off-site works including the preparation of SSWSIs.

2.6.3 **Archaeological Clerk of Works (ACoW).** One will be appointed by each Main Works Contractor and will be responsible for monitoring the work undertaken by the Archaeological Contractor(s) within the relevant contract area, to ensure compliance with the AMS-OWSI and the SSWSIs. They will also be responsible for liaising with the Main Works Contractor to monitor construction activities to ensure compliance with the AMS-OWSI.

2.6.4 **National Highways Historic Environment Manager.** They will be appointed by National Highways to provide oversight across the three separate contract

areas and ensure that the whole archaeological mitigation programme is delivered in accordance with the principles, aims and objectives of the AMS-OWSI. They will be responsible for liaison with key heritage stakeholders and have oversight of any external communications.

- 2.6.5 **Local Authority Archaeological Advisors.** They advise the Local Planning Authorities (LPAs) across the Project. They are Kent County Council for the LPAs within Kent; Essex County Council, through Essex Place Services for the LPAs within Essex; and the Greater London Archaeological Advisory Service for the London Borough of Havering. The Local Authority Archaeological Advisors will monitor the fieldwork to ensure that it is carried out to the required standard and specification as set out in the AMS-OWSI and the relevant SSWSIs and ensure that it will achieve the desired aims and objectives. The relevant Local Authority Archaeological Advisors will attend site meetings, to review the progress and results of the fieldwork. These meetings will also be used to inform sign off of sites prior to construction.
- 2.6.6 **Historic England.** They will advise where designated assets, or assets with the potential to be designated are affected by the Project. They are also a source of expert specialist advice on archaeological science.
- 2.6.7 **Local Authority Historic Buildings Advisors.** The Local Authority Historic Buildings Advisors will monitor the recording of historic structures and their setting to ensure that it is carried out to the required standard and specification as set out in the AMS-OWSI and the relevant SSWSIs and ensure that it will achieve the desired aims and objectives. The relevant Local Authority Historic Buildings Advisors will attend site meetings, to review the progress and results of the recording.

2.7 Structure of the dAMS-OWSI

- 2.7.1 Section 1 to Section 7 of this document comprise the Archaeological Mitigation Strategy. It describes the principles to be applied when designing and implementing archaeological mitigation for the Project. It proposes strategies and approaches for the protection of archaeological remains to be retained and for the investigation, recording, analysis, and publication of archaeological remains to be removed in advance of construction.
- 2.7.2 Section 8 of this document comprises the outline written scheme of investigation (OWSI). The application strategy for each of the mitigation approaches is discussed and outline method statements are presented. These will form the basis of the works to be detailed in the SSWSIs.
- 2.7.3 Sites or areas where archaeological mitigation approaches will be applied are identified in Table 9.1, Table 9.2, and Table 9.3.
- 2.7.4 The requirements for communication, monitoring and reporting are identified and the procedure for completion of archaeological works is set out.
- 2.7.5 Assessment, reporting and archiving requirements for the post excavation process are outlined.

3 Principles and objectives for archaeological mitigation

3.1 Principles

- 3.1.1 This section of the document describes the principles that will apply to archaeological mitigation for the Project.
- 3.1.2 The principles will be applied to all archaeological work carried out across the entire Project. Those that are relevant to a site or archaeological mitigation action area will be specifically mentioned in the relevant SSWSI.
- 3.1.3 Archaeological mitigation is required where there will be an unavoidable impact on archaeological remains and associated deposits, including elements of historic landscape character. Historic building recording is required where there will be an unavoidable impact on a historic building and photographic or other recording is required where there will be an unavoidable impact on historic landscapes. The sites of archaeological interest, historic buildings and historic landscapes which will require mitigation were initially identified in Chapter 6: Cultural Heritage.
- 3.1.4 One scheduled monument and three listed buildings will experience substantial harm as a result of the Project. The highest standards of recording (detailed excavation and Level 4 Buildings Recording) will be carried out on these Heritage Assets.
- 3.1.5 The principles set out below seek to guide actions to ensure the conservation of heritage assets throughout the Order limits.
- a. The consideration of the cultural heritage of the Project as a whole should be inclusive and include archaeological remains from palaeoenvironmental evidence up to and including remains of the last century.
 - b. All Heritage Assets whether archaeological remains, historic buildings and historic landscapes, should be given equal weight appropriate to their significance.
 - c. Archaeological works should be undertaken to a high standard that adequately reflects the significance of the heritage assets and the scale and importance of the Project.
 - d. The design of mitigation work should take into account applicable Government guidelines on planning and archaeology, including the relevant NPSs, NPPF and National Planning Practice Guidance and DMRB.
 - e. Organisations and individuals undertaking archaeological work along the Project should do so within the ethical and professional standards set out in the ClfA Code of Conduct, Bylaws, Standards and Policy Statements (<https://www.archaeologists.net/codes/cifa>) (as updated from time to time).

- 3.1.6 The archaeological mitigation approach in this dAMS-OWSI will be developed and implemented through the SSWSIs in line with the following parameters:
- a. Observe professional codes, guidance and standards.
 - b. Ensure that all field staff involved in the mitigation programme are aware of the significance of the heritage assets along the Project through provision of a Project specific induction.
 - c. Review and assess the considerable information already available from relevant prior investigations before designing any new works.
 - d. Consider archaeological and cultural heritage evidence from all periods and its contribution to the understanding of the historic landscape and its use over time.
 - e. Only undertake extensive intrusive works in areas where there will be a direct impact through development.
 - f. Utilise the information provided by other disciplines (for example, geotechnical investigations).
 - g. All works must take account of all statutory designations.

3.2 Objectives

- 3.2.1 All those undertaking archaeological work associated with the Project will:
- a. Ensure a detailed programme of archaeological work is in place to appropriately mitigate impacts on any archaeological remains due to the Project.
 - b. Promote high quality research using intensive excavation methodologies and scientific techniques to explore a transect through the landscape and investigate past settlement patterns, develop new research questions and feed back into the relevant research strategies.
 - c. The results of archaeological investigation will be published within an appropriate period following assessment and analysis (see Chapter 8 below for further details). The results of fieldwork interventions should be combined into a single report.
 - d. Ensure that the results of the investigations are:
 - i. made publicly available in an appropriate format for assimilation into the relevant Historic Environment Records,
 - ii. develop an understanding of the historic environment resource of the Project by the public at large; and

- iii. disseminated in a timely manner via the Online Access to the Index of Archaeological Investigations (OASIS) and the Archaeological Data Service (ADS).

3.3 Aims of each mitigation technique

3.3.1 Archaeological mitigation for the Project will take many forms, ranging from preservation of a site in situ, excavation, sampling and detailed recording. Further details of these techniques are contained within Chapter 6 and 7. The mitigation techniques and the aims of each technique are presented in Table 3.1 below.

Table 3.1 Aims of each Mitigation Technique proposed for use on the Project

Ref	Type	Method	Description and Aim
1.0 Preservation in situ			
1.1		Avoidance	Mainly achieved through design as embedded mitigation but can be recommended when significant archaeological remains are discovered during archaeological work or construction. The aim is to avoid damage to heritage assets by removing any potential impact
1.2		Burial or sealing of remains with barrier membrane	Burying or sealing remains beneath fill material to ensure that they are not disturbed (including use of a protective barrier membrane between the buried remains and the fill material. The aim is to avoid damage to heritage assets by removing any potential impact
1.3		Fencing	Measures for preservation in situ would include protective fencing. The aim is to avoid damage to heritage assets by removing the potential for unintended impacts
1.4		Track matting	Where vehicle movements are unavoidable, the aim of track matting is to avoid damage to buried archaeological remains caused through compression or rutting
1.5		Control of plant movement	Where possible the aim is for control measures for plant movement to avoid damage to buried archaeological remains through compression or rutting
2.0 Recording of heritage assets			
2.1		Archaeological topographic/ earthwork survey	An archaeological site survey carried out to record the shape and topography of the ground surface and any relevant components. The aim is to create a record of any archaeological remains before they are lost, wholly or in part, to advance understanding of the significance of the archaeological assets

Ref	Type	Method	Description and Aim
2.2		Archaeological photographic recording	A photographic record combined with a written description of a heritage asset that records its current condition, character and type. The aim is to create a record of any heritage assets before they are lost, wholly or in part, to advance understanding of the significance of the heritage assets.
2.3		Historic building recording	<p>A programme of recording of historic buildings to be lost due to the Project, which can include documentary research, photographic and drawn records of the interior and exterior of the building. The aim is to create a record of any historic building before they are lost, wholly or in part, to advance understanding of the significance of the historic building.</p> <p>In some situations, for example where a building is not lost but the setting is altered, the recording will extend to the setting of the building and will record their relationship and the extent of the existing setting.</p> <p>Where a historic building or structure has been identified as having the potential to be impacted by vibration as a result of the Project, a condition survey, proportionate to the predicted impact, will be carried out before that element of the Project begins.</p>
2.4		Historic Landscape recording	A combination of techniques 2.1, 2.2 and 2.3 to record historic landscapes and their components before they are significantly altered. The aim is to create a record of an historic landscape before it is lost, wholly or in part, to advance understanding of the significance of the historic landscape
3.0 Non-intrusive archaeological fieldwork			
3.1		Fieldwalking	A non-intrusive archaeological survey technique used to record the position and distribution of artefacts recovered from a rapid survey of the ploughed surface of a field. This can be carried out in conjunction with 4.1. The aim is to create a record of the distribution of archaeological artefacts within the ploughzone, to advance understanding of the significance of the archaeology of a given area and to inform the development of further mitigation
3.2		Controlled metal detecting	The systematic metal detecting of a given area to allow the plotting and recording of any metalwork. There are two aims, firstly to create a record of the distribution of archaeological artefacts within the ploughzone, to advance understanding of the significance of the archaeology of a given area and to inform the development of further mitigation,

Ref	Type	Method	Description and Aim
			and secondly to recover any archaeological metalwork from topsoil during intrusive archaeological fieldwork
3.3		Geophysical Survey	A non-intrusive archaeological survey technique used to identify differences between buried archaeological remains and surrounding soil. The purpose of this is to understand likely presence, extent and nature of buried archaeological remains.
4.0 Intrusive archaeological fieldwork			
4.1		Topsoil artefact sampling	An intrusive archaeological survey technique used to record the position and distribution of a sample of artefacts recovered from test pitting of the ploughzone. This can be carried out in conjunction with 3.1. The aim is to create a record of the distribution of archaeological artefacts within the ploughzone, to advance understanding of the significance of the archaeology of a given area and to inform the development of further mitigation
4.2		Detailed excavation	A programme of controlled, intrusive fieldwork with defined objectives which maps, examines, records and interprets archaeological remains at a site or within a specified area. The aim is to create a record of any archaeological remains before they are lost, wholly or in part, to advance understanding of the significance of the archaeological assets
4.3		Strip, map and sample excavation	Strip, map and sample comprises the archaeologically controlled strip of a defined area within the Order Limits under the direction of a suitably qualified archaeologist. The aim is to create a record of any archaeological remains before they are lost, wholly or in part, to advance understanding of the significance of the archaeological assets
4.4		Trial trench evaluation	Archaeological trial trench evaluation carried out in areas within the Order Limits where land access was not available prior to public examination. The aim is to determine the presence or absence of archaeological deposits, their state of preservation and to inform the development of further mitigation
4.5		Geoarchaeological and palaeo-environmental investigation	A programme of sample recovery and assessment/analysis carried out to investigate palaeoenvironmental conditions and soil sediment development that may be relevant to the research of archaeological sites or remains found within the vicinity. Achieved through trial pit excavations or other soil sample retrieval methods (such as auger or boreholes). The aim is to provide additional information and context to any archaeological

Ref	Type	Method	Description and Aim
			remains before they are lost, wholly or in part, to advance understanding of the significance of the archaeological assets
4.6		Palaeolithic and Holocene intrusive investigation	A programme of sample recovery and assessment/analysis carried out to investigate the dry valleys across the Project, the Ockendon Channel, the Mar Dyke and the Thames gravel terraces, to examine areas of colluvium, to identify potential remains within or below the deposition sequences. This will be achieved through large test pits, trial pit excavations or other soil sample retrieval methods (such as auger or boreholes). The aim is to provide additional information to advance understanding of the significance of these deposits
5.0 Monitoring during construction			
5.1		Archaeological monitoring and recording (watching brief)	A programme of observation, investigation and recording of archaeological remains carried out in specific areas where the presence of, or moderate potential for archaeological remains has been demonstrated or can be predicted. The aim is to create a record of any archaeological remains before they are lost, wholly or in part, to advance understanding of the significance of the archaeological assets
6.0 Outreach and engagement			
6.1		Outreach Officer	An archaeologist with specific responsibilities for outreach and engagement with and beyond the local community.
6.2		A programme of outreach activities	This could include presentations, talks, public events and exhibitions.
7.0 Post-excavation			
7.1		Conservation and assessment	A programme of post-excavation assessment, analysis and reporting would be carried out.
7.2		Analysis and reporting	Archaeological post-excavation analysis (including but not limited to environmental sample analysis, Carbon 14 and OSL dating and other specialist inputs), and reporting.
7.3		Archiving	The deposition of the archive in an approved local museum or other repository.
8.0 Publication			
8.1		Publication	Publication of the results in a range of formats including academic and more popular publications.

4 Summary of archaeological investigations carried out by the project

4.1 Background

- 4.1.1 A programme of archaeological trial trenching was started in the Essex part of the Project in November 2019. A Project wide specification for archaeological trial-trenching (ATT) was prepared and in July 2019 the Applicant commissioned Balfour Beatty to deliver the pre-enabling works. Balfour Beatty appointed Oxford Archaeology (OA) to prepare a project-wide written scheme of investigation (WSI) for the Project, which (at the request of the Key Archaeological Stakeholders) is divided into two parts, one for the Kent section south of the River Thames, (Chapter 6: Cultural Heritage, Appendix 6.11) the other for Essex and Havering north of the River Thames (Chapter 6: Cultural Heritage, Appendix 6.12)
- 4.1.2 Detailed WSIs for each group of land parcels within the Project to be investigated by the ATT have also been prepared. Each WSI area was made up of Land Parcels, each given a unique number by Oxford Archaeology. The areas covered by each WSI, and the land parcels included in each, are shown on Chapter 6: Cultural Heritage Figure 6.7. Each detailed WSI was submitted for approval by the Local Authority Archaeological Advisor.
- 4.1.3 The summary below describes the key results from each land parcel from the south of the Project at the A2 to the north of the Project on the M25. Each land parcel is presented within its WSI area and follows the same format. A brief introduction, a summary of the predicted archaeological potential, a description of the soils encountered in the ATT followed by a summary of the results.

4.2 Overview of archaeological trial trenching

South of the River Thames

- 4.2.1 A total of 1059 trial trenches were excavated for the Project south of the River Thames within the county of Kent. Most of these trenches were situated within the North Kent Plain National Character Area (NCA), with the northern edge of the site extending slightly into the Greater Thames Estuary NCA. This report summarises the results of the trial trench evaluations undertaken to date and outlines the key findings.

WSI V: Land parcels 80 and 81

Introduction

- 4.2.2 Archaeological Trial Trenching of 379 trenches in land parcels 80 and 81 were completed between the 21 May and 14 August 2020. Twenty-eight trenches could not be excavated as planned.

- 4.2.3 Land parcels 80 and 81 are bounded to the east by Thong Lane and several houses to the west of this road, to the south by the A2 and to the west and north by a suburb of Gravesend. A farm track bisects the centre of the site on a NE-SW alignment, but land ownership is divided differently between the western and eastern sides of the site along boundaries orientated NNE and then NNW, although cultivation appears to cross these boundaries. Land parcel 81, which is made up of four parts, covers most of the western half of the site whereas the eastern half of the site is all within land parcel 80.
- 4.2.4 Most of the site consists of agricultural land, while the south-western part of land parcel 81 is covered by Claylane Wood. The central and south-western part of land parcel 80 comprises several pasture fields to the west of Thong. A modern pond is in the south-western part of land parcel 80 adjacent to the A2. In the surrounding 1km, land use consists of a mixture of agricultural use, woodland and urban development associated with the suburbs of Gravesend and the hamlet of Thong.
- 4.2.5 The site is situated partly on a slope and terrace of chalk and Thanet Sand associated with the upland part of the North Downs. The upland area located towards the south of the site increases to a height of 75-80m aOD in the area of Claylane Wood, and c 95m aOD at the south-western corner of the site adjacent to Thong Lane and the A2. There is a gradual and steady slope down from this to c 55m aOD at the western edge of the site and c 70m aOD at the northern edge of the site. One dry valley is indicated by the topographical map (OA 2020a, fig. 4) within the western part of the site and Head Diamicton appears to have accumulated in this area. Further possible dry valleys are indicated by other areas of Head Diamicton within the site.

Anticipated Archaeological Potential

- 4.2.6 A watching brief took place within the site during the excavation of the Chalk to Shorne gas main in 1970. This watching brief recorded an undated V-shaped ditch within land parcel 81 (Kent Archaeological Society 1970, 187). In addition, a fieldwalking survey was undertaken within the site in 1999 prior to the construction of the Shorne-to-Farningham gas pipeline (Network Archaeology 1999).
- 4.2.7 A geophysical survey of the site and surrounding area was conducted in 2019 (Chapter 6: Cultural Heritage, Appendix 6.7). The geophysical survey did not include the wooded areas, nor did it quite extend to the eastern limits of land parcel 80 adjacent to the village of Thong, as the limits of the Project have been extended since the survey was carried out.
- 4.2.8 The cropmarks have been recorded by the National Mapping Programme, including cropmark data and airfield data for Gravesend Airport.
- 4.2.9 The geophysical survey and NMP data identified several potential archaeological features within the area of the site. This includes a ditch, a rectangular enclosure, another partial enclosure, a trackway and enclosure with possible remains of a building. These features may be later prehistoric/Roman or medieval in date.

Soils

- 4.2.10 The soil sequence across the site mainly comprised natural deposits of either orange-brown silty sand (Thanet Sands) or the underlying chalk bedrock. Within the dry valleys these were variously overlaid by Holocene colluvium (hillwash/ploughwash) and Pleistocene slope deposits. Numerous patches of Pleistocene silt, usually distinguished by their orange-brown colour, were found in hollows and gullies in the surface of the chalk.
- 4.2.11 A subsoil layer (largely c 0.1-0.3m thick) of mid-brown silty sand was encountered in most trenches and this overlay the natural geology. This may be the relict remains of a former ploughsoil which has been eroded, probably by the modern ploughing. Within the dry valleys, the colluvial deposits consisted of greater depths of hillwash/former ploughsoil, often over 1m deep in total. Subsoil and natural were overlain by a topsoil/ploughsoil which was a dark grey-brown silty clay or silty sand and was 0.2-0.4m thick.

Summary of Results

- 4.2.12 Archaeological features were recorded in 136 of the 379 trenches excavated.
- 4.2.13 Apart from the northern and western fringes which had limited archaeology, the archaeological features were distributed throughout the site. The density of features is greater in the eastern half of the site; other concentrations tend to correspond to the cropmark and geophysical evidence.
- 4.2.14 The evaluation provided evidence for Neolithic worked flint, including one spread of flint on a buried land surface in the base of a dry valley sealed by colluvium. A molluscan assemblage from a buried soil in another trench in the dry valley indicated an old woodland environment of Mesolithic or early Neolithic date. Several other groups of flint in fairly fresh condition came from pits scattered across the site, one also including pottery of early Neolithic date. Other residual groups in later pits, a sinkhole or quarry and a ditch show other former foci of Neolithic activity. Some of the flintwork could alternatively be later Mesolithic.
- 4.2.15 The earliest dated feature is a pit of middle Bronze Age date in the southern part of the site, and a north west to south east boundary crossing the southern end of the site may have been dug in the late Bronze Age. Another significant linear boundary on the western side of the site was formed by two parallel ditches 4-6m apart and aligned north north west to south south east along the north edge of the main dry valley that lay north of Claylane Wood. The larger ditch was on the downslope side, and the smaller ditch had gaps along its line. The pattern of fills shows that the spoil had been upcast to form a bank between the two ditches. This boundary may also have its origins in the late Bronze Age, although dating was limited, and only a small proportion of the primary fills was excavated. Pottery suggests that it continued in use throughout the early Iron Age, and middle Iron Age pottery was found in the top in one trench. Beyond the end of the cropmark of these ditches to the south, the western ditch continued southward as a smaller ditch with a bank on the east (upslope) side to the edge of another dry valley running in from the east north east.

- 4.2.16 Where the cropmark ended, a pair of smaller ditches continued east north east along the northern edge of the second dry valley across several trenches, but then appeared to stop. Where the dry valley ended, another pair of large ditches - this time representing successive, intercutting boundaries - continued eastwards and effectively formed a boundary between the plateau areas to the north and south.
- 4.2.17 North of these boundaries on the flat upland plateau, and on the east side of the site, there was a concentration of pits and postholes of late Bronze Age/early Iron Age date. Two of the pits contained briquetage in some quantity suggesting that salt manufacturing was taking place on the site during these periods. Middle Iron Age activity on the site was sparser but included a pit south of the boundaries described above, together with a rectangular or square enclosure at the very NE corner of the site.
- 4.2.18 Late Iron Age activity is difficult to distinguish from early Roman activity, and no definitively late Iron Age features were found. A B-shaped pair of linked enclosures was found west of the focus of earlier Iron Age pits and postholes, and pottery from some of its ditches suggested an origin in the mid-1st century AD, while a cremation burial found within the enclosure was accompanied by two brooches dating AD 20-80. A second cremation burial to the north-east of the enclosure contained several iron nails and may indicate that the cremated remains were placed in a box. Activity within and around the enclosure continued into the 2nd-3rd centuries AD. Within the enclosure, several pits contained Roman roof and flue tiles and brick. Only one feature contained late Roman pottery, indicating that activity had all but ceased by this time. A probable trackway extended south from the northern end of the site towards the focus of Roman occupation, and at the very north-western edge of the site was a cremation-burial pit containing an adult interred with three pottery vessels, including a Samian dish suggesting a date of c AD 70-100/110. This was probably related to an early Roman farmstead excavated below the Gravesend suburb of Hillside to the west of the site.
- 4.2.19 There was no evidence of activity on site during the Saxon period and medieval remains were limited to a few quarries near to the settlement at Thong. Post-medieval activity was mostly limited to field boundaries.
- 4.2.20 In the 20th century, the site was occupied by Gravesend airfield, and several structures peripheral to the taxiway were found. Evidence of the main runway and airfield structures was very slight, limited to a couple of features in a single trench.

WSI U: Land parcels 76 and 77

Introduction

- 4.2.21 Archaeological Trial Trenching of 172 trenches in land parcels 76 and 77 were completed between the 8 June and 4 September 2020. Thirty-three trenches could not be excavated as planned due to access issues.
- 4.2.22 Land parcels 76 and 77 are situated north of Shorne Ifield Road and are bounded to the east by Green Lane (Muggins Lane). Land parcel 78 to the west was not yet accessible for evaluation. They total an area of 31.86ha.

4.2.23 The site is situated partly on a slope and terrace of chalk and Thanet Sand associated with the upland area of the North Downs. A detailed topographical model is not available for the southern edge of the site, but the topography is confirmed by OS mapping. The upland area located towards the south of the site increases to a height of 75-80m aOD. This slopes steadily down to c 60m aOD at the northern edge of the site. In addition, two dry valleys are located within the western and eastern part of the site, and these are where the areas of Head Diamicton have accumulated.

4.2.24 Land parcels 76 and 77 are both arable fields.

Anticipated Archaeological Potential

4.2.25 A geophysical survey of the site and surrounding area was conducted in 2019 (Chapter 6: Cultural Heritage, Appendix 6.7). Cropmarks have been recorded by the National Mapping Programme including cropmark data and airfield data for Gravesend Airport.

4.2.26 In 1999 a fieldwalking survey took place within the site and bisected land parcels 76 and 77. This was undertaken along the route of the proposed Shorne to Farningham Gas Pipeline and only recorded finds in the footprint (20m either side) of the proposed pipeline. Mesolithic and Late Neolithic to Early Bronze Age worked flints were found within land parcel 77 of the site (Network Archaeology 1999).

4.2.27 A large number of ring ditches and possible ring ditches are recorded as cropmarks in the fields to the north, and two of the possible examples are located less than 50m north of the site. Many of these possible barrows were sited on the edge of the dry valleys that traverse the area, particularly Southern Valley, which runs along much of the northern edge of the site. A potential enclosure looks to extend southwards into land parcel 77, however the only cropmark noted within the site itself is a potential enclosure that is partially within the north-east corner of land parcel 76.

Soils

4.2.28 The soil sequence across the site mainly comprised natural deposits of either orange-brown silty sand (Thanet Sands) or the underlying Chalk bedrock. Within the dry valleys these were variously overlaid by colluvium (hillwash/ploughwash) and Pleistocene slope deposits.

4.2.29 A subsoil layer (largely c 0.1-0.3m thick) of mid brown silty sand was encountered in most trenches and this overlay the natural geology. This may be the relict remains of a former ploughsoil which has been eroded, probably by the modern ploughing. Within the dry valleys, the subsoil became thicker (up to 0.41m), possibly included reworked colluvium. The subsoil and natural was overlain by a topsoil/ploughsoil which was a dark grey brown silty clay or silty sand and was largely between 0.2-0.4m thick.

Summary of Results

4.2.30 Archaeological features were recorded in 60 of the 172 trenches excavated.

- 4.2.31 Archaeological features were noticeably less prevalent or were absent along the northern part of the site, which is contrary to the cropmark evidence. The exception to this was in the north-east corner of land parcel 76, where the features corresponded with the cropmark evidence.
- 4.2.32 Struck flint provided certain evidence of early Mesolithic activity, and also an adze-sharpening flake, blades and bladelets of later Mesolithic or early Neolithic date. A backed knife and a Levallois core are Later Neolithic or early Bronze Age, and denticulates probably of Bronze Age date. Several groups of flakes are of later prehistoric character.
- 4.2.33 The evaluation provided evidence for middle Bronze Age activity that included a deliberately buried pottery vessel, possibly within a posthole structure. Parallel ditches containing pottery of later Bronze Age or early Iron Age date possibly formed an enclosure. Two unurned and undated cremations and two cenotaph pits may indicate a cemetery of later Bronze Age date. A square cropmark enclosure in the north-east corner of the site has proven to be of early-middle Iron Age date. A middle Iron Age pit and an adjacent, but undated, four-post structure containing charred grain represent another focus on the south side of the site. Roman activity is largely confined to an enclosure and a large pit, both of early Roman date, in the west of the site.
- 4.2.34 Colluvial deposits were investigated and found to seal later prehistoric features in some areas and Roman ones in others, so were generally of late date. One buried soil contained a fresh prehistoric flint flake, but others contained mixed flint, often in poor condition, and so were also mostly late in date.
- 4.2.35 An early-middle Saxon large pit was found on the eastern edge of the site. Its upper levels contained a significant quantity of pottery dated to c 550-750, together with an antler comb and iron debris.
- 4.2.36 Medieval evidence included the remains of a probable corn-dryer or malting kiln, together with several ditches and pits, all near to the eastern edge of the site. A boundary ditch evident on historic maps was traced, and at one point also contained medieval pottery, just possibly indicating a medieval origin.
- 4.2.37 The remains of a brick building alongside the Shorne Ifield road corresponded to a building depicted on the 1894 Ordnance Survey map.

WSI T: Land parcels 71, 72, and 75

Introduction

- 4.2.38 Archaeological Trial Trenching of 508 trenches in land parcels 71, 72, and 75 were completed over two phases of fieldwork between 30 April to 25 September 2020, and from 17 September to 8 October 2021. Fifty-seven trenches could not be excavated as planned.
- 4.2.39 Land parcels 71, 72 and 75 are located east of Chalk and Gravesend and either side of the A226 Rochester Road within the county of Kent (NGR 567938, 172207).
- 4.2.40 The western edge of land parcel 72 was still under crop during the 2020 evaluation, and access to this was therefore denied. The combined area available for evaluation for both phases of fieldwork was 75.03 ha.

- 4.2.41 Land parcel 71 is a narrow rectangular area north of the A226 that widens out at the north, where it ends at the Horton Road, and is bounded by open fields on the west and east. Land parcels 72 and 75 form a polygon whose north-east side was the A226, bordered on the north-west by the village of Chalk, and east of land parcel 71 by the Church of St Mary and Gravesend Crematorium. On the south-east and south side, the limits of land parcel 75 are also bounded by further open fields. The west side, and the southern part of the north-west side, are bounded by Southern Valley golf course and north of this by an open field.
- 4.2.42 Land parcels 71, 72 and 75 are situated partly on a slope and terrace of chalk associated with the upland area of the North Downs. The upland area rises to a height of 61-66m aOD. This lies largely to the south of the site, but a plateau extends north-eastwards into the site. The slopes fall steadily northwards down to 1m aOD at the northern limit of the site on the edge of the north Kent marshes. A dry valley runs south-west to north-east across the south-eastern part of the site, and two smaller dry valleys lie to the west of this within the northern part of the site. All are aligned south south west to north north east. The dry valleys contain the accumulated deposits of Head Diamicton.
- 4.2.43 The land is currently in use as agricultural fields.

Anticipated Archaeological Potential

- 4.2.44 A 1999 archaeological investigation within the site was carried out in relation to pipeline excavation indicates concentrations of both Iron Age and Roman features, including part of a Roman inhumation cemetery.
- 4.2.45 One Bronze Age barrow within land parcel 75 was excavated in 1899. It was found to contain a crouched inhumation and five additional crouched burials in the ditch.
- 4.2.46 Large numbers of late Neolithic and early Bronze Age flints were recorded within land parcel 75 during fieldwalking for the Shorne to Farningham gas pipeline.
- 4.2.47 Cropmarks mapped through NMP cropmark data and geophysical survey have identified further probable features, such as ring ditches, trackways, and enclosures which are likely to date to the multiple periods and which are targeted by this trial trenching. Most of these features are concentrated within the central area, where similar features of prehistoric, Romano-British and medieval date have been identified.

Soils

- 4.2.48 The ploughsoil measured between 0.2 and 0.4m thick across the site. In some areas this overlay a subsoil layer up to 0.36m thick. The underlying bedrock geology was chalk across the site. Mixed head deposits of clay, silt, sand and gravel were present in the southern, elevated portion of the site and outcrops of Pleistocene river terrace deposits recorded at the northern limit of the site bordering the Thames floodplain. Deep colluvial sequences were found in the dry valleys that covered much of the site.

Summary of Results

- 4.2.49 Archaeological features were recorded in 181 of the 508 trenches excavated.

- 4.2.50 The greatest concentration was at the north end of land parcel 75, where a significant later prehistoric and Roman settlement had already been identified by previous mitigation in advance of gas pipelines. There were enclosures and ring ditches identified as cropmarks or by geophysical survey on the plateau areas between the dry valleys in all three land parcels, and a variety of linear boundaries, and most of these provided finds or environmental remains. There were also a significant number of colluvial layers and buried soils in the dry valleys that contained archaeological finds, including in situ and derived flint concentrations, particularly in land parcel 75. The range of material recovered included struck flint of Palaeolithic, Mesolithic, Neolithic and Bronze Age date, and pottery of all periods from Neolithic to post-medieval, together with a wide range of other types of artefacts.
- 4.2.51 Within land parcels 71 and 72 archaeological features were dominated by enclosures situated on the chalk plateau, although there was a concentration of medieval features at the north end of land parcel 71, and there were several small dry valleys with colluvial deposits containing artefacts and sealing buried features or soil horizons. Archaeological features were most numerous in land parcel 75, where a late prehistoric and Roman site extended 100m south from the A226, from which high status pottery and evidence of former buildings was recovered. A dry valley crossed by the settlement area proved to contain a well-preserved Roman road resurfaced on numerous occasions.
- 4.2.52 The major dry valley ran the whole length of land parcel 75, and proved to contain deep sequences of Pleistocene, Late Glacial and Holocene deposits. Struck flints of middle Palaeolithic date came from derived gravel deposits, interspersed in two trenches with late Upper Palaeolithic (LUP) slope deposits containing fresher flintwork.
- 4.2.53 Other LUP slope deposits had diagnostic molluscan assemblages. A Mesolithic in situ flint scatter incorporating burnt areas or 'hearths' on the upper slopes of the valley was dated to the mid-6th millennium cal BC. Other trenches on the east side of the valley also contained significant assemblages of Mesolithic flint, indicating a focus of Mesolithic activity here. Little Neolithic activity was identified, but a burnt mound buried below colluvium was associated with an assemblage of struck flint of late Neolithic or early Bronze Age date and a sherd of Beaker pottery. Three ring ditches all produced flint assemblages consistent with an early Bronze Age date, and one a sherd of Biconical Urn. One unurned cremation at the south end of the site was also radiocarbon-dated to the end of the early Bronze Age.
- 4.2.54 Middle and late Bronze Age activity was sparse, although a fair proportion of the struck flint was of later prehistoric date. An unurned cremation was radiocarbon-dated to the middle Bronze Age, and one group of pits in the dry valley, buried below a buried soil and a deep deposit of colluvium, which included later Bronze Age pottery, was also radiocarbon-dated to the middle Bronze Age. This may indicate a sealed and well-protected horizon. A pit containing middle Bronze Age sherds and a ditch with a sizeable assemblage of struck flint and some pottery of later prehistoric character were found close to the floodplain at the north end of the site. Late Bronze Age or earliest Iron Age activity was confirmed by radiocarbon-dating of a deposit of charcoal and burnt flint in a hollow adjacent to the (probably) earlier burnt mound.

- 4.2.55 A sub-rectangular enclosure was dated to the early-middle Iron Age, and there were two major ditched land boundaries to the south of similar date. Trackways that continued in use in the Roman period may have originated in the Iron Age, with groups of later prehistoric pits alongside one of these. A rectilinear enclosure on the south edge of the site was of middle Iron Age origin, continuing into the late Iron Age and Roman periods, and another rectilinear enclosure in land parcel 71 was of late Iron Age/early Roman date. Two further enclosures in land parcel 72, one sub-square, the other the shape of an inverted bell, were dated to the Roman period. A partial neonate inhumation burial was also found but was not dated.
- 4.2.56 A rectilinear enclosure of Roman date was found straddling land parcels 72 and 75 just south of the Gravesend to Rochester road, whose ditches included early-middle Roman pottery, bricks and tiles, suggesting that a high status building lay within it. Other features in this area suggest that this enclosure probably overlies a late Iron Age settlement focus. Numerous metal finds have previously been recovered from this area, together with a late Roman cemetery, supporting interpretation as a significant settlement of long duration. This settlement was associated with a trackway that was preserved as an upstanding causeway across the base of the dry valley to the east of the enclosure.
- 4.2.57 Medieval activity was limited to the north end of land parcel 71, where pits and ditches were found adjacent to the Lower Higham Road at the edge of the Thames floodplain. A post-medieval quarry or denehole was found further south within this land parcel. Post-medieval linear boundaries, some evident on historic maps, were confirmed running through land parcels 72 and 75 along the plateau above the large dry valley, and another double boundary or narrow trackway ran across a dry valley in land parcel 71 towards the Thames floodplain.

North of the Thames

WSI R: Land Parcel 12

Introduction

- 4.2.58 Archaeological Trial Trenching of 98 trenches in land parcel 12 were completed between the 1 September and 27 October 2021. Six trenches could not be excavated as planned due to weather conditions.
- 4.2.59 Land parcel 12 is situated in the parish of West Tilbury (NGR TQ 564047 180101). The accessible area of the land parcel measures 16.53ha and is bounded to the north by the London, Tilbury and Southend Railway. A current landfill covers the majority of land parcel 12 which was not evaluated. The site comprises an area of rough pasture and open fields.
- 4.2.60 Land parcel 12 is within a lowland area with an estuarine character at approximately 1m aOD. A sinuous feature borders this land parcel to the east is likely to be the course of a former creek and forms the parish boundary of West and East Tilbury.
- 4.2.61 Trenches measured up to 6m wide to allow for stepping of the trench to a depth of 2m.

Anticipated Archaeological Potential

- 4.2.62 In 1993 a number of finds were recorded in the north-eastern part of the study area during the construction of the Horndon-Tilbury Gas Pipeline.
- 4.2.63 A 200m wide strip along the north-west edge of land parcel 12 had geophysical survey done in advance of the proposal to construct a gas main. It recorded a potential enclosure with an annex between the two westernmost fields within land parcel 12 about 120m south of the railway line. Approximately 150m east of the possible enclosure was a line of five large discrete anomalies possibly representing archaeological features.
- 4.2.64 A small number of discrete cropmarks have been identified within the site which are targeted by the trenching. However, the site comprises a former marshland area and it contains evidence for a number of co-axial ditches and earthworks of north-south aligned trackways. The co-axial field boundaries are former almost certainly field boundary ditches of possible medieval or post-medieval date. A system of drainage would have been essential to use the low-lying area for pasture. The trackways appear as earthworks consisting of ditches on either side of central tracks visible for over 1.5 km. Four of these trackways are visible running in a north-south direction across the former salt marsh and are located within the site, referred to as site 44 in the Aerial Investigation and Mapping Report (ES Appendix 6.2, Application Document 6.3). It is possible that these tracks were droveways of medieval or post-medieval date. Some of these droveways appeared to start at farms (such as Gravel Pit Farm) or settlements (like Low Street) via green lanes that appear to still be in existence in places, often defined by parallel ditches. These droveways may have been used to take livestock down to the marshes for grazing. A number of these droveways and field boundaries have been levelled by later activity such as Tilbury Power Station and recent landfill sites and a large modern development towards the coast.
- 4.2.65 The walkover observed a raised platform earthwork within the western part of land parcel 12. This earthwork was situated directly west of a droveway and may be the remains of a building, perhaps another farm cottage. The tithe map and OS maps do not show any buildings at this location, so if this platform did represent a building it is likely to predate the mid-19th century.
- 4.2.66 This area also had a number of fixed Second World War defensive positions including a number of Alan-Williams Steel Turrets, which were located along major roadways. A number of road blocks were also in place but were temporary structures. A large number of anti-glider ditches were located within land parcels 12.

Soils

- 4.2.67 The soil sequence was relatively consistent across the site with alluvial clay deposits overlain by subsoil and ploughsoil. For the majority of the trenches the natural geology was not reached, even though some of the trenches were excavated in part to a depth of 3m below ground level. A single trench near the northern edge of the site revealed the underlying gravel terrace and a thick layer of peat was also encountered near the base of the investigated sequence in the central northern section of the site.

Summary of Results

- 4.2.68 Archaeological features were identified in 11 out of the 98 trenches and mostly comprised field boundary ditches and drainage ditches.
- 4.2.69 As anticipated from existing borehole data, the trenches revealed that most of the site was covered in Holocene alluvium to a depth more than 2m. At the north-west edge of the site, however, Pleistocene gravels were exposed at the northern end of Trench 9, and were located by augering in several adjacent trenches, indicating that a gravel shelf existed at relatively shallow depth along this edge of the site. The remainder of the trenches were unable to expose the full sequence of Holocene deposits or establish clearly whether there was archaeological activity upon this shelf.
- 4.2.70 The earliest artefact from the site was a blade-like flake recovered from an alluvial deposit in Trench 18, not far beyond the edge of the gravel shelf. This piece was probably Mesolithic/early Neolithic in date but was likely to have been redeposited, despite being in good overall condition.
- 4.2.71 At just below 2m down, Trench 3 revealed a peat deposit with a layer of waterlogged wood remains. The main concentration of wood was close to the surface of the peat and included substantial lengths of roundwood trunks that had split in half, and had subsequently been heavily eroded, presumably during exposure prior to burial by later alluvial deposits. Several of the surrounding trenches also revealed peat with waterlogged wood preservation, but none of the wood exhibited signs of working.
- 4.2.72 The wood was mostly aligned from south west to north east parallel to the edge of the gravel terrace and is believed to have split naturally from a mixed carr-type woodland comprising conifers, ash, alder and oak. A series of samples submitted for radiocarbon dating indicated that this peat accumulated from the late Neolithic to the end of the early Bronze Age. This is consistent with peat formation elsewhere on the Lower Thames floodplain. Two pieces of struck flint and a burnt flint were also found in this layer, a hard hammer struck flake being consistent with the date of the wood upon which it was found.
- 4.2.73 A later dark brownish grey clayey silt horizon was evident in a number of trenches across the site and was interpreted as a buried soil horizon. A fragment of charcoal from this was radiocarbon-dated to 780-510 cal BC, showing that this deposit must have formed in or after the early Iron Age. Animal bone fragments were found on this horizon in a nearby trench. A patch of flint cobbles was associated with what is probably the same buried horizon and may have been hardstanding or possibly related to a path.
- 4.2.74 Most of the trenches revealed sterile alluvial deposits formed from successive phases of inundation. The only other features were several post-medieval ditches from two phases of drainage and land partition, the earlier probably 16th - 18th century, the later matching land boundaries on 19th century historic maps.

WSI J: Land Parcel 37

Introduction

- 4.2.75 Archaeological Trial Trenching of 42 trenches in land parcel 37 were completed between the 21 September and 8 October 2020.
- 4.2.76 Land parcel 37 is located between West Tilbury and East Tilbury, south- west of Station Road and measures a total area of 5.8ha.
- 4.2.77 It occupies a small promontory at the western end of a plateau which overlooks the tidal floodplain to the south. The south-east edge of the site is relatively flat and occupies the highest ground within the parcel, c 12m aOD. The site drops away moderately steeply to the north- west, along a break of slope that bisects the site on a south west to north east orientation. The south-west edge of the site is very steeply sloped, descending to the lowest part of the site just 2m aOD.

Anticipated Archaeological Potential

- 4.2.78 No known previous investigations had taken place within land parcel 37.
- 4.2.79 There is a group of cropmarks within land parcel 37 which may indicate the presence of later prehistoric settlement activity (ES Appendix 6.2 site 44 (Application Document 6.3)). This consists mainly of a series of ditches, some of which form right angles, together with occasional discrete features.

Soils

- 4.2.80 The soil sequence for the majority of the trenches comprised ploughsoil overlying subsoil, with an underlying geology of either sandy gravels or silty clay. On the sloped areas of the site, colluvial layers and deeper subsoil deposits were also recorded.
- 4.2.81 In Trenches 17 and 26 a silty gravel deposit was observed between the orange gravel natural and the subsoil. The origins and development of this deposit are unclear, but it was truncated by all associated archaeology and evidently predates the recorded human activity on the site.

Summary of Results

- 4.2.82 Archaeological features were recorded in 26 of the 42 trenches excavated.
- 4.2.83 As indicated by the cropmark features, most of the archaeology was confined to a 70m wide strip along the plateau along the south-east edge of the site. Particularly dense concentrations of discrete features were recorded on the trenches that were within the area demarcated by a series of enclosure ditches, the most significant of which were several ditches forming a north east to south west aligned boundary and a return which was north west to south east aligned.
- 4.2.84 The earliest activity was a middle Neolithic pit, but the main phase of occupation belongs to the late Bronze Age and/or early Iron Age. Evidence for middle Iron Age activity was equivocal, but there was further settlement in the late Iron Age and early Roman periods. The prehistoric activity included widespread evidence of salt-working in the form both of features with purplish stains, and briquetage, and the pottery of the early Roman period included regional and continental imports, suggesting that the site was both Romanised and of reasonable status.

4.2.85 The scale of activity contracted in the middle Roman period, and evidence for late Roman activity was limited to a single sherd of pottery. The last significant phase of activity was the early and middle Saxon period (AD 400-750), consisting of pits, postholes and several large shallow features (only partially exposed) that may be sunken-featured buildings indicating permanent settlement. Anglo-Saxon activity was more widely spread than the earlier activity on the high ground. Medieval activity was limited to a few sherds of pottery from ditches and a pit in the north-east corner of the site, and it is unclear whether these features were medieval or later.

4.2.86 Some of the exposed ditches matched the alignment and were close to the line of field boundaries on historic maps, and most other ditches, including the cropmark boundaries, ran either on or at right angles to these alignments, suggesting that the site was divided into smaller land parcels in the past, originating either in the medieval or post-medieval period.

WSI Q: Land Parcels 6 (South), 8 (South) and WSI I: 9, 10 and 36

Introduction

4.2.87 Archaeological Trial Trenching of 230 trenches in land parcels 6 (South), 8 (South), 9, 10, and 36 was completed between 20 August and 7 October 2020.

4.2.88 Land parcels 6, 8, 9, 10 and 36 are located between the settlements of East and West Tilbury and adjacent to the hamlet of Low Street within the county of Essex and Thurrock unitary authority (NGR 566809 178261). This site comprised parts of five land parcels (land parcels 6 (south), 8 (south), 9, 10 and 36) located mainly south of the Muckingford Road and north of the London, Tilbury and Southend Railway. The site covers an area of 82.72ha. Land parcels 6 (south) and 8 (south) are narrow strips adjacent to the Muckingford Road on the north side. Land parcel 10 is located west of Low Street Lane which bisects the site north to south. Land parcels 9 and 36 are located east of Low Street Lane and west of the modern part of East Tilbury.

4.2.89 Church Road bisects the southern part of the site on an east-west alignment. The site is also bisected by four green lanes including one named Coal Lane. Apart from a very small area on the gravel terrace at the north-west corner of the site, these land parcels are situated on the slopes of a dry valley that runs north to south east of West Tilbury. The western edge of the site is located at c 20m aOD and this decreases to below sea level at the south-eastern edge of the site. The lowest part of the site corresponds with the location of an area of Head Clay. The nearest watercourse to the site is a north-south aligned creek leading from the Thames estuary to the south, which becomes a pond within the southern part of the site. The line of this creek has historically formed part of the boundary between the parishes of West Tilbury and East Tilbury.

4.2.90 Land parcel 6 (south) is the southern edge of a large arable field, land parcel 8 (south) the edge of a smaller arable field. Land parcel 9 comprises five arable fields, two areas of scrub and woodland and a large pond. Land parcel 10 forms part of four arable fields within the western part of the site, and also includes a very small part of Condoovers Scout Activity centre. Land parcel 36 forms parts of three larger arable fields at the eastern edge of the site.

Anticipated Archaeological Potential

- 4.2.91 In the early 1990s a pipeline was laid by British Gas passed through the eastern part of the site and close to the excavated Bronze Age barrow. This revealed a middle Bronze Age cremation cemetery, which was excavated as part of this Project. A number of worked flints were identified elsewhere along the route but are not dated any more specifically than as prehistoric (Smoothy 1993).
- 4.2.92 A geophysical survey followed by an archaeological excavation was undertaken in 2005 which included the eastern part of the site (Oxford Archaeology 2005). This evaluation found a Bronze Age settlement east of the current site that was subsequently excavated, and within the site uncovered a number of Roman field systems and a possible area of Roman settlement.
- 4.2.93 A sub-square cropmark enclosure is evident within the centre of the site and located on the east side of the dry valley (ES Appendix 6.2 site 41A (Application Document 6.3)). This enclosure is located next to several circular cropmarks and appears to be associated with linear features, one of which could be a NW-SE aligned trackway. The sub-square enclosure may have been associated with a system of rectilinear fields or enclosures running north north east to south south west along the gravel terrace and up to the edge of the dry valley on its east side (ES Appendix 6.2 sites 41B and 43 (Application Document 6.3)). This group of cropmarks is hypothesised to be of later prehistoric or Roman date.

Soils

- 4.2.94 The soil sequence encountered across the site generally comprised natural geology of sandy gravels, overlain by subsoil and ploughsoil, although in some trenches the natural substrate was directly overlain by the ploughsoil. Colluvial layers were recorded in the dry valley that crosses the central part of the site. In the south of the site (Trenches 155, 156, 157, 159 and 160) the natural geology was overlain by a deposit of made ground at least 0.8m deep in places. This had presumably been laid down to help raise an area of low-lying land deemed to be a flood risk.

Summary of Results

- 4.2.95 Archaeological features were recorded in:
- both of the two trenches excavated in land parcel 6 (south);
 - one of the three trenches excavated in land parcel 8 (south);
 - 49 of the 150 trenches excavated in land parcel 9;
 - eight of the 58 trenches excavated in land parcel 10; and
 - five of the 16 trenches excavated in land parcel 36.
- 4.2.96 The evaluation confirmed the presence of several linear and curvilinear features within the site that had been identified as cropmarks by the aerial investigation and mapping report (ES Appendix 6.2 (Application Document 6.3)). The primary focal point of dense activity was situated in and around the rectangular enclosure within the centre of land parcel 9. The two trenches in land parcel 6 (south) are on the very fringes of a complex cropmark site which is outside of the project boundary.

- 4.2.97 The earliest archaeological evidence recorded during the evaluation was represented by a small assemblage of residual Mesolithic/Neolithic blade-based flints retrieved from a small undated ditch in the northern part of the site. A ditch containing a small amount of early Neolithic pottery and flints including a flint scraper was revealed at the north-eastern edge of the site, and colluvium at the north-west edge contained fresh Neolithic flintwork and pottery potentially of early Neolithic date.
- 4.2.98 Evidence of later prehistoric activity was scattered right across the site, but with a possible focus in the centre. Four circular pits, one containing middle Bronze Age pottery, the others late Bronze Age pottery, in association with hearths, oven furniture and charred plant remains, were found in the northern and central parts of the site, and later Bronze Age struck flint in colluvium and an erosion gully in a dry valley. Small amounts of pottery of later Bronze Age or early Iron Age date came from several other pits and small ditches in the northern and eastern parts of the site.
- 4.2.99 The centre of the site contained cropmarks of a sub-rectangular enclosure with an associated field system, and a circular smaller enclosure adjacent on the west. No finds came from the curving ditch of the circular cropmark, but two unurned cremation pits were found within the area enclosed by the curvilinear ditch, and although not dated, may well indicate a small Bronze Age barrow or flat cemetery. To the east, and within the sub-rectangular enclosure, a later Bronze Age or early Iron Age complete ceramic vessel had been placed upright in a pit and may represent associated activities. The only finds from the sub-rectangular enclosure ditches were a couple of small sherds, one of late Iron Age/early Roman or 10-11th century date, the other of early Medieval date, in the top of one ditch. The sub-rectangular enclosure is not therefore securely dated, and no finds were recovered from the associated field system.
- 4.2.100 Two ditches located in the western and central parts of the site contained small, abraded quantities of late Iron Age/Roman pottery indicated very limited Roman activity. Two isolated medieval pits, one containing pottery, the other a horseshoe, were found in the southern and eastern parts of the site.
- 4.2.101 A boundary ditch and two very large pits, probably indicating quarries, all containing Tudor pottery and 16th -18th century CBM, were revealed at the very south end of the site adjacent to the hamlet of Low Street. Several ditches that corresponded to historic mapping were also recorded.

WSI Q: Land Parcels 6, 7, and 8

Introduction

- 4.2.102 Archaeological Trial Trenching of 224 trenches in land parcels 6, 7 and 8 was completed between 13 July and 18 October 2021. Twenty trenches could not be excavated as planned.
- 4.2.103 The total land area of parcels 6, 7 and 8 was 59.64ha, and the area available for investigation excluding areas of services, hedgerows and other constraints was 33.05ha. The land parcels are situated west of the village of Linford within the county of Essex and Thurrock unitary authority (NGR 566625 179242).
- 4.2.104 The north western, western and southern parts of the site are currently arable fields. The central part of the site contains a pond and the course of a former

brook that is aligned roughly east-west and is lined with trees. To the north and north-east of this is a further open field and larger areas of scrub land. The north-eastern part of the site is partly occupied by the Tarmac building products works.

- 4.2.105 The site is situated across a substantial dry valley which runs east-south-east through the gravel terraces to either side. Several smaller dry valleys also feed into this major valley from the north east, and it is within these valleys that the Head and alluvial deposits have accumulated. The majority of the site is located on the slopes and in the bottom of these dry valleys. The highest ground within the site is at the north-eastern edge of land parcel 7, where the edge of the terrace reaches a height of c 25m aOD. The lowest part of the site is along the course of the brook in the centre of the site at c 6mOD. The dry valley deepens beyond the east edge of the site and continues north-east to the Mucking marshes and the River Thames.

Anticipated Archaeological Potential

- 4.2.106 Cropmark evidence revealed through aerial investigation (ES Appendix 6.2, AP79 (Application Document 6.3)) is limited to:
- 4.2.107 a series of linear cropmarks near the western edge of land parcel 6, potentially representing part of an enclosure and a driveway.
- 4.2.108 The cropmarks of an undated double ditched rectangular enclosure that is c 100m long and wide is located within the central part of the site. This enclosure appears to have an entrance on the southern and western side. Another rectangular feature is also located just to the south and a possible trackway to the north-west which is on a north west to south east alignment ES Appendix 6.2 site, 25 (Application Document 6.3)). The trackway appears to be leading from Hoford Road which might suggest that this enclosure is contemporary with the road. The date of Hoford Road is unknown, it may have originated as a later prehistoric trackway, as a Roman road or as a medieval driveway.
- 4.2.109 The 2021 LiDAR analysis of the site identified a bank aligned north east to south west with a ditch either side in the north-western part of the site. These features follow the topography of a promontory and are part way up a slope. The promontory is located at the intersection of two dry valleys and defines the plateau on which the multiperiod site of Mucking is situated c 400m north east of the site. The bank terminates at another east-west bank within the site which can also be seen on the LiDAR, and this may be later in date. The north east to south west aligned ditch above the bank continues south-eastward and is roughly defined by the south-western boundary of Rainbow Wood. Intriguingly, if the line of this ditch is followed south-eastwards it matches a linear feature associated with a rectangular cropmark enclosure which is located within the northern part of the site (ES Appendix 6.2 site 24A (Application Document 6.3)). The ditch may post-date the enclosure or may be contemporary with it. This enclosure is located on a low rise of ground projecting southwards from the promontory. It is possible that the enclosure and series of banks and ditches are later prehistoric in date (perhaps Iron Age) and define the edge of a promontory as part of a wider territory including Mucking to the north-east. The banks and ditches may have become fossilised in the landscape and later became part

of the late Saxon manors/medieval parishes of Mucking and West Tilbury). Alternatively, they may represent later boundaries.

Soils

- 4.2.110 The soil sequence was varied across the site due to changes in topography, groundwater and the underlying geology. Generally, the more elevated areas of the site in the north of parcel 6 and along the northern edge of parcel 7 revealed a shallow ploughsoil coming directly onto the underlying geology. Moving down from the highest sections of the site an accumulation of colluvium was found between the ploughsoil and the underlying geology, which was inevitably thickest in the base of the dry valleys across parcels 6 and 7. In places, this colluvium overlay areas of buried soil. In the valley base of land parcel 7a, the high groundwater level had contributed to the development of a humic peaty soil beneath the colluvium. Beneath this was further colluvium that overlay Pleistocene deposits. Although relatively flat compared to other areas of the site, a shallow colluvium was also recorded in some of the trenches in the central and southern section of parcel 7c. Up to 0.3m thick, this overlay the natural geology and was truncated by the archaeological features.

Summary of Results

- 4.2.111 Archaeological features were recorded in:
- a. 16 of the 49 trenches excavated in land parcel 6
 - b. 28 of the 49 trenches excavated in land parcel 7a
 - c. 3 of the 16 trenches excavated in land parcel 7b
 - d. 45 of the 92 trenches excavated in land parcel 7c
 - e. 11 of the 16 trenches excavated in land parcel 8.
- 4.2.112 The evaluation recorded a variety of archaeological activity, with the earliest evidence represented by at least two possible late Upper Palaeolithic flint blades. These were recovered from amongst a much more substantial assemblage of later Mesolithic flint artefacts that were identified as surface scatters across nine trenches in land parcel 7a and 7b and in the fills of tree-throw holes and natural features in three trenches in land parcel 7c and residually in features in two trenches in land parcel 7c and 8 further east. Mesolithic activity was concentrated towards the base of the valley, most clearly in land parcel 7a, but also extending eastwards across land parcel 7b and the north ends of land parcels 7c and 8. Together these indicate an occupation area of regional importance.
- 4.2.113 It is possible that an element of the extensive flint scatters may prove to be of early Neolithic date, as the flint technology is very similar, but no diagnostic pieces of this date have yet been found in association with them. Evidence for early Neolithic activity was otherwise indicated by a small number of features and deposits bearing either flintwork or pottery of possible early Neolithic date. These were widely dispersed across the site and tended to occur without any clear focus. This pattern continued into the later Neolithic and early Bronze Age

with the recovery of occasional flintwork and a single sherd of possible Beaker pottery recovered from a later feature.

- 4.2.114 No certainly middle Bronze Age features or finds were identified, although several undated concentrations of charcoal and burnt flint were found that may represent burnt mounds, which are typically of middle or late Bronze Age date. A small number of features dated to the late Bronze Age were recorded including a pit in land parcel 6 which produced a large assemblage of pottery and numerous fragments of briquetage. Activity that is more likely of late Bronze Age than early Iron Age date was concentrated in the western part of the site. The main focus of Iron Age settlement, in contrast, was in the east of the site across land parcels 7c, where a number of trenches revealed a concentration of pits, ditches and postholes that continued and developed into the middle Iron Age, extending into land parcel 8.
- 4.2.115 Pottery of late Iron Age/early Roman fabrics tended to be associated with definitely early Roman pottery, making identification of a separate late Iron Age phase uncertain. In the early Roman period, activity was concentrated in land parcel 8, overlapping with the area of Iron Age settlement. A perforated kiln plate indicates the presence of a kiln nearby. Ditches of early Roman date followed two predominant orientations, suggesting a field or enclosure system, and these also mirror the lines of some Iron Age ditches, suggesting a degree of continuity of field or enclosure boundaries. The proximity of the Roman activity to the cropmark enclosure just east of the evaluated part of land parcel 8 may indicate that the enclosure was also of Roman date. Early to middle Anglo-Saxon evidence was limited to two sherds of pottery from a pit in the northern part of land parcel 6. Several undated features were recorded in the vicinity including a rectangular enclosure previously identified as a cropmark, which may indicate a broader focus of activity contemporary with the pit. A little distance to the south-east was a ditch dating to the Saxo-Norman period.
- 4.2.116 In the centre of land parcel 7a, and extending across several trenches in the valley bottom, was a spread of pits dating from the 11th to 13th centuries. Although no structural evidence was directly associated with these, the assemblage of pottery and environmental remains suggest a domestic setting and perhaps the presence of a farmstead. It is possible that the double-ditched enclosure evident as a cropmark just to the north of these, which was confirmed but not dated by the evaluation, was a stock enclosure associated with this domestic activity.
- 4.2.117 Several post-medieval boundary ditches were located by the evaluation, some also marked on historic maps. Among other undated features was a crouched inhumation recorded in Trench 176, which contained residual finds of prehistoric pottery and flint, but for which insufficient collagen remained to obtain a radiocarbon date. Although crouched burials are found at several periods in prehistory and into the early Roman period, the burial is most likely to be later Bronze Age or Iron Age in date.

WSI E: Land Parcel 5

Introduction

- 4.2.118 Archaeological Trial Trenching of 168 trenches in land parcel 5 was completed between the 6 January and 14 of February 2020.

- 4.2.119 Land parcel 5 is located directly north east of the town of Chadwell St Mary within the county of Essex and Thurrock unitary authority (NGR TQ 65603 79864). The land parcel is roughly rectangular with two projecting areas to the south and covers an area of 32.59ha. It is bounded to the west by Brentwood Road, to the north by Orsett Golf Course and a field, to the south by further fields and to the south-west by Chadwell-St-Mary. High House Lane, a single-track road, runs through the north-western part of the land parcel. An industrial works road, constructed to allow works traffic to access an agricultural reservoir, lies within the north-western part of the land parcel. There is a small farm (Brook Farm) within the western part of the land parcel.
- 4.2.120 The land parcel is situated across the west end of a dry valley which runs east south east across the gravel terrace to the south of Orsett. A 'tributary' valley also runs west north west south of land parcel 5 and joins the main valley in the eastern part of the parcel. The northern edge of this 'tributary' is clipped by the southern extension along High House Lane. The highest ground within the land parcel is in the south-western corner, where the terrace is at a height of c 24-25m aOD. There is a gradual slope down to the north and north-east, and the northern edge of the land parcel runs roughly along the dry valley, the lowest point within the site being halfway down the eastern side of the parcel at a height of 5-20m aOD.

- 4.2.121 The land is currently in use as an arable field.

Anticipated Archaeological Potential

- 4.2.122 No known below-ground archaeological investigation has been undertaken previously within this land parcel.
- 4.2.123 Cropmarks of number possible ring-ditches have been identified both within the centre of the land parcel and close to it. The ring-ditch, or possible hut circle within land parcel 5 is located in the centre and is 8.6m in diameter. A number of linear features and two bands of pits are located within the land parcel (ES Appendix 6.2 site 24A (Application Document 6.3)), while three ring-ditches and several pits have been recorded west and south-west of the land parcel (ES Appendix 6.2 site 18 (Application Document 6.3)). It is possible that these cropmarks are indicative of Bronze Age/Iron Age activity, as revealed by the Mill House Farm evaluation, c 500m south of land parcel 5
- 4.2.124 The route of a possible Roman road is projected to run through the western part of the site on an north north east to south south west alignment.
- 4.2.125 The linear and discrete features located within land parcel 5 are mostly scattered with a slight focus within the centre of the site. Other than the potential ring ditch, the features also include a possible sub-rectangular enclosure towards the east of the land parcel, linear features and sections of enclosure in the centre and linear features towards the west. There are also a number of pits and amorphous features that have been mapped by the aerial survey.

Soils

- 4.2.126 The soil sequence varied across the site: on the east and north exposed slope, the silt and sand deposits of the Thanet Formation are overlain by Pleistocene solifluidal slope deposits (locally over 1.0m thick). In the western part of the

area adjacent to the Boyn Hill Gravel Member lenses of solifluidal clayey sandy gravel up to 0.3m thick form the base of the slope deposit. Isolated deposits of Holocene colluvium, up to 0.9m thick, occur locally on lower slope positions at the eastern edge of the area.

- 4.2.127 The topsoil comprised a dark grey brown silty clay or silty sand plough soil, which was generally 0.2-0.4m thick.

Summary of Results

- 4.2.128 Archaeological features were found in 91 trenches.
- 4.2.129 The evaluation confirmed the presence of several linear and curvilinear features within the site, which had been identified as cropmarks by the aerial investigation and mapping report in ES Appendix 6.2 (Application Document 6.3). However, the density of the cropmarks within the centre of the site was found to be predominantly geological in origin.
- 4.2.130 The nature of the archaeological resource within land parcel 5 is therefore much more dispersed than the cropmarks suggest. A number of areas of the site also recorded loose groupings of archaeological features which were not noted within the aerial investigation:
- 4.2.131 the northern part of the site revealed archaeological features in 11 trenches, six of which had features which contained late Bronze Age to early Iron Age pottery
- 4.2.132 the eastern part of the site revealed archaeological features in nine trenches, one of which had a dense concentration of linear features and pits which contained sherds of late Bronze Age to Iron Age pottery
- 4.2.133 the southern part of the site also revealed a scatter of previously unidentified features in 15 trenches including features with evidence for Neolithic/early Bronze Age, middle Bronze Age, and late Bronze Age / Iron Age activity – including a cremation burial.
- 4.2.134 Archaeological findings of note are:
- 4.2.135 There was an assemblage of 113 worked flints and 725 fragments of burnt flint recovered across the site, primarily from the ploughsoil. Two late Mesolithic microliths were recovered in trenches 64 and 155 which are both on lower lying ground close to the base of a dry valley. This may be suggestive of Late Mesolithic activity along the former water course.
- 4.2.136 One pit (trench 47) in the central southern part of the site produced 31 sherds of late Neolithic to early Bronze Age Beaker pottery, large quantities of charcoal, 46 worked flints including flakes, blades, and scrapers, and some fired clay. The pit was isolated in an area of the site that was otherwise relatively devoid of archaeological features.

- 4.2.137 A linear feature was recorded in the eastern part of the site correlates to the cropmarks, the shape of which suggests a sub-rectangular enclosure. A small quantity of pottery recovered from this ditch in one trench was dated to the late Bronze age to Iron Age period and substantial assemblage of middle Bronze Age pottery from another trench. Carbonised cooking residue was present of some sherds suggesting domestic activity. The nature of the enclosure is difficult to determine, however, with a scatter of isolated linear features from the interior being of indeterminate function.
- 4.2.138 The investigation of the potential ring ditch cropmark recorded this feature but found no dating evidence.

WSI D: Land Parcel 4

Introduction

- 4.2.139 Archaeological Trial Trenching of 139 trenches in land parcel 4 was completed between the 13 and 30 of January 2020.
- 4.2.140 Land parcel 4 is located directly north of the suburbs of Chadwell St Mary, 0.7km south of the A13, within the county of Essex and Thurrock unitary authority (NGR TQ 64996 80073). The land parcel, comprising two arable fields, is roughly rectangular and has two projecting sections on the north edge, covering a total area of 21.47ha. The site is bounded to the west by a public footpath and hedgerow, to the south by a public footpath and a residential area, and to the east by Brentwood Road, while the northern boundary bisects an open arable field.
- 4.2.141 Land parcel 4 is situated across the western end of a dry valley which runs east across the gravel terrace to the south of Orsett. The land parcel itself contains areas of higher ground towards the southern edge at c 24-25m above Ordnance Datum (aOD); to the north-west, where the elevation is similar; and in the north-east corner, where ground levels rise to over 35m aOD. The base of the dry valley crosses the northern part of the land parcel, with the lowest point at c 20m aOD. Consequently, a gradual slope downwards from the south edge of the field is perceptible on site, and a somewhat steeper slope rising towards the north-east corner. Within the dry valley, slope deposits and colluvial layers of Head have accumulated. No permanent streams are marked in the immediate vicinity of the land parcel, but a drainage ditch is located 280m to the east, which may represent the remnants of a stream which joined another further down the valley at Linford (1.3km to the south-east).
- 4.2.142 The land is currently in use as an arable field.

Anticipated Archaeological Potential

- 4.2.143 No known below-ground archaeological investigation has been undertaken previously within this land parcel.

- 4.2.144 The site is situated on the terrace to the south of the Mar Dyke valley where prehistoric features, find spots and cropmarks have been identified. The cropmarks identified through aerial investigation (ES Appendix 6.2 (Application Document 6.3)) within the site boundary include:
- the cropmarks of two ring-ditches; hypothesized to be a potential round barrow and roundhouse
 - the route of a possible Roman road which is projected to run roughly north-south through the north-eastern part of land parcel 4
 - linear east-west and north-south aligned cropmarks which are likely to represent post-medieval field boundaries shown on the 1840 Orsett Tithe map
 - a small number of undated discrete and short linear features, most of which are within the southern half of land parcel 4

Soils

- 4.2.145 The soil sequence varied across the site with the natural geology comprising silty sand with gravels and clayey silt deposits. A borehole recorded by the BGS on the northern edge of the site (TQ68SE109 at 565130,180290) indicates that the Boyn Hill sand and gravel extends c 1.5m below the surface in this area. This suggests that only this surface geology was encountered during this evaluation, and that some of the geological variation within the site may be heavily influenced by the dry valley deposits as well as the change at the northern edge of the site from Thanet Sand bedrock to the more mixed Lambeth Group deposits comprising a mixture of clay, silt and sand.
- 4.2.146 Subsoil and slope deposit layers ranging between 0.25-0.7m thick were encountered across the site, with the thicker slope deposit sequences located in trenches along the northern edge of the site within the lowest points of the dry valley identified by the LiDAR data. The shallower subsoils are more likely to represent the relict remains of a former ploughsoil which now lies below the current plough depths.
- 4.2.147 Slope deposits and/or colluvial sequences were recorded in a total of 35 trenches, mostly towards the northern and eastern extents of the land parcel. This broadly matches the extent of the dry valley mapped by the LiDAR data.
- 4.2.148 The topsoil consisted of mid grey brown silty clay or silty sand measuring between 0.24-0.4m thick.

Summary of Results

- 4.2.149 Archaeological features were encountered in 43 of the trenches, with clusters of activity in the south-east corner as well as the westernmost part of the site.
- 4.2.150 The evaluation confirmed the presence of several linear features within the site which had previously been identified as cropmarks (ES Appendix 6.2 (Application Document 6.3)). These features are likely to be representative of post-medieval field boundaries. However, the broader scatter of large discrete cropmarks did not match any archaeological features within the trenches; this continues the trend observed in previous land parcels where these cropmarks have typically been indicative of geological variations.

- 4.2.151 Twenty-six trenches contained only deep slope and colluvial deposits, with some also including areas of natural variation and/or root disturbance. Sixteen trenches revealed only natural features. These were confirmed by hand excavation. No features or colluvial/head deposits were encountered in 53 trenches.
- 4.2.152 The majority of the trenches towards the northern edge of the site revealed deep slope deposits marking a roughly north west to south east aligned dry channel. This corresponds with a large linear trend visible on available LiDAR data, which maps a dry valley continuing further east into land parcel 5.
- 4.2.153 Small assemblages of Neolithic material were encountered in Trenches 19 and 51, comprising worked flint, pottery and hazelnut shells. These demonstrate a low level of activity over a wide-ranging area that is probably contemporary with the life span of the causewayed enclosure located to the north of the site boundary.
- 4.2.154 It is also notable that a number of other pits were recorded that included charred remains as the primary or main fill but failed to produce any dating evidence. It is entirely possible that these also date to the early prehistoric period. There is also a pit arrangement recorded in Trench 36 whereby five pits appeared to be laid out in a semi-circular arrangement. This may have particular significance if this pit cluster can be shown to date to the early prehistoric period, as this would have the potential to comprise a hengiform-style monument in close proximity to the causewayed enclosure.
- 4.2.155 Only the most southerly, larger ring ditch indicated by the cropmarks was recorded during the evaluations in trenches 121 and 122. No dating evidence was obtained, though it is still possible that this represents the remains of a Neolithic or early Bronze Age barrow.
- 4.2.156 Trenches 24, 124 and 125 included Iron Age remains, although the evidence is relatively sparse and does not suggest any high-level activity within the site. Evidence for Romano-British remains was confined to Trench 37 at the western edge of the evaluation area. This suggests that the focal point of activity during the Roman period lay further to the west, within the adjacent land parcel 3 (Hornsby Lane), where evidence for more complex industrial activity was encountered.
- 4.2.157 Several north north east to south south west and west north west to east south east-aligned ditches encountered in the western half of the site match the orientations of post-medieval field boundaries marked on 1st Edition Ordnance Survey mapping. In addition, two wall lines and associated features encountered in Trenches 138 and 139 are likely related to the demolished Seaborough Hall. A single pit in Trench 139 provides some evidence for a late medieval presence at Seaborough Hall.

WSI C: Land Parcel 3

Introduction

- 4.2.158 Archaeological Trial Trenching of 116 trenches in land parcel 3 was completed between the 7 December 2019 and 15 January 2020. The rest of evaluation for land parcel 3 (North) was undertaken separately.

- 4.2.159 Land parcel 3 is situated approximately 100m east of the hamlet of Orsett Heath within the county of Essex and Thurrock unitary authority (NGR TQ 64442 80214). The land parcel has a straight southern edge and three projecting sections to the north and covers an area of 22.98ha. This land parcel is located 200m south of the A1013 and 400m south of the A13 and is bounded to the west and north-west by fields. It is located to the south of Whitecroft care home and is bounded to the north-east by Heath Place, to the east by a footpath and hedgerow and to the south by an agricultural field. Hornsby Lane, a single-track road, passes through this land parcel and a small farm with a farmhouse and several outbuildings is located within the south-western part of the site.
- 4.2.160 The land parcel is situated partly within a dry valley with areas of higher ground towards the southern and northern edge where the ground is c 24-25m aOD. A dry valley orientated east-west is situated along the centre line of the land parcel, with the lowest point at c 20m aOD.
- 4.2.161 The land is currently in use as an arable field.

Anticipated Archaeological Potential

- 4.2.162 No known below-ground archaeological investigation has been undertaken within this land parcel previously.
- 4.2.163 Land parcel 3 is situated on the terrace to the south of the Mar Dyke valley, where a number of prehistoric features, findspots and cropmarks have been identified previously.
- 4.2.164 A large number of intercutting cropmarks are present within land parcel 3 and it is likely that multiple periods are represented, possibly dating from the Neolithic, Iron Age and Roman period (ES Appendix 6.2 site 20 (Application Document 6.3)). There appears to be several phases of occupation within land parcel 3. One phase is possibly associated with a north-south trackway within the western part of the land parcel. A number of east-west linear features within the land parcel may be associated with this north-south trackway or they may be far later in date. There are also several small enclosures within the land parcel, which may belong to an earlier phase. Some of the earlier cropmark features appear to have been cut by a large north west to south east aligned rectilinear enclosure of possible Roman date.
- 4.2.165 A putative Neolithic mortuary enclosure is located within the north-western part of the land parcel. If this is a mortuary enclosure, this may be one of the earliest features within this extensive cropmark sequence and is potentially highly significant.
- 4.2.166 A large quantity of high-status Iron Age material was recovered by metal detectorists within a field close to Hornsby Lane and within the northern part of the land parcel. This findspot is thought to be associated with an Iron Age phase of occupation which may pre-date the large rectilinear enclosure located in land parcel 3.

Soils

- 4.2.167 The soil sequence across the site was fairly uniform with a natural geology of orangey yellow or yellow-brown silty sand with gravel. The natural that was encountered is the superficial deposits of the Boyn Hill Sand and Gravel, which covers the Thanet Sand in this area.
- 4.2.168 A thin subsoil layer (c 0.1-0.2m thick) of brown silty sand was encountered in the majority of trenches and this overlay the natural geology. This may be the relict remains of a former ploughsoil which has been eroded, probably by the modern ploughing. The subsoil and natural was overlain by a topsoil/ploughsoil which was a dark grey brown silty clay or silty sand which was 0.2-0.4m thick.
- 4.2.169 A possible colluvial layer was encountered in Trenches 40 and 43 in the central, northern part of the site. In both cases this layer contained Roman pottery and, in Trench 43, the colluvial layer was 0.4m thick. The colluvial layer in Trench 43 was found in the area of a possible dry valley where the BGS record the presence of Head Clay deposits (BGS 2019). This area is the lowest part of the site. The colluvial layer containing Roman material may have moved downslope, suggesting that the Roman pottery in the layer is residual, or that this accumulated during the Roman period.

Summary of Results

- 4.2.170 The evaluation confirmed the presence of several linear and discrete features within the site that had been identified as cropmarks within the Aerial Investigation and Mapping Report (ES Appendix 6.2, Application Document 6.3) and during geophysical survey. There was a strong correlation between the areas of cropmarks and the features revealed by the trenching.
- 4.2.171 Archaeological features were identified in 59 trenches.
- 4.2.172 The evaluations within land parcel 3 produced a high density of complex features which retain a high level of archaeological interest. Key areas of archaeological interest include:
- 4.2.173 The eastern end of the potential mortuary enclosure was found but only survived 50mm deep and no dating evidence was obtained. The dating of this feature is therefore still uncertain.
- 4.2.174 The complex cropmark site with a primary rectilinear enclosure and further surrounding enclosures was confirmed by the evaluation; many of the ditches produced pottery dating to the middle to late Roman period, as did the probable trackway along its south edge.
- 4.2.175 Two well-preserved large kilns were found, in Trenches 45 and 47, and several other ovens or kilns in Trenches 33, 39 and 46. The large pottery kilns were left unexcavated to preserve the remains for a more detailed mitigation phase. The surface artefacts that were recovered indicate a late 2nd-3rd century date for the infill of these.
- 4.2.176 A mid-2nd century AD human cremation burial was found in Trench 15 and a possible cremation in Trench 45. This suggests that there are likely to be further cremation burials located within the site.

WSI G: Land Parcels 3 (north), 30 and 35

Introduction

- 4.2.177 Archaeological Trial Trenching of 167 trenches in land parcels 3 (North), 30 and 35 was completed between the 28 September and 27 October 2020. The rest of evaluation for land parcel 3 was undertaken separately, see above. Twenty-five further trenches could not be excavated as planned due to weather and access constraints.
- 4.2.178 Land parcels 3 (North), 30 and 35 are situated either side of the A13 c 300m north east of the hamlet of Orsett Heath within the county of Essex and Thurrock unitary authority (NGR 564149 180821). The combined area of the site is 32.7ha.
- 4.2.179 Land parcel 35 and the eastern part of land parcel 3 (North) lies on an upland area. A dry valley crosses the western part of the site oriented north-west to south-east, which includes the western part of land parcels 3 (North) and 30. West of this the ground rises again. The eastern part of the site rises sharply up to the gravel terrace, which is at 30–34m aOD. To the east the Boyn gravel terrace is lower than on the west, approaching 26m aOD. The Mar Dyke river lies 2.7km to the north-west, and this is the nearest large river to the site.
- 4.2.180 The land is currently in use as arable fields.

Anticipated Archaeological Potential

- 4.2.181 Land parcel 3 as a whole is situated primarily on the terrace to the south of the Mar Dyke valley, where a number of prehistoric features, findspots and cropmarks have been identified. A large number of undated cropmark features have been identified during aerial investigation and mapping, some of which are within the southern area of land parcel 3 (North), but most of which are within the rest of land parcel 3.
- 4.2.182 Within land parcel 30 there is a comparatively small number of cropmark features identified during the photographic assessment; however, the cropmark of a possible ring ditch, which may represent a ploughed-out round barrow, was identified at the western edge of land parcel 30 (ES Appendix 6.2 site 21 (Application Document 6.3)).
- 4.2.183 Land parcel 35 is situated just north of a major junction of the A13 and the former location of a double-ditched enclosure known as 'Orsett Cock'. During excavation it was found to be a defensive enclosure in the middle to late Iron Age and subsequently as a farmstead with pottery kilns during the Roman period. Evidence of Saxon occupation was also recorded. Construction and widening of the A13 is likely to have truncated much of the resource within immediate vicinity of the roadway; though archaeological investigations within the area just south of land parcel 35 during A13 works recorded a sequence of Roman ditches and ditches with prehistoric and medieval dating evidence.
- 4.2.184 Cropmark evidence from aerial photographic assessment (Place Services 2019) suggest that there are further linear cropmarks within land parcel 35 which may be similar to those previously excavated.

Soils

- 4.2.185 The soil sequence was broadly similar across the three parcels. Despite the changes in topography, there was little evidence for colluvial accumulation and no buried soil horizons were observed. The natural geology was overlain, where present, by a subsoil deposit which was in turn sealed by the ploughsoil. The composition of the ploughsoil varied between sandy silt and clay silt across the three parcels, depending on the underlying geology.
- 4.2.186 Across parts of land parcel 3 (North), particularly on the higher ground to the east, and some areas of land parcel 30, the depth of overburden proved to be remarkably shallow. In some instances, the archaeological horizon was little more than 0.3m beneath the surface.

Summary of Results

- 4.2.187 Archaeological features were identified in:
- 35 trenches of the 69 trenches excavated in land parcel 3 (North)
 - 52 of the 68 trenches excavated in land parcel 30; and
 - 21 of the 30 trenches excavated in land parcel 35.
- 4.2.188 The evaluation confirmed the presence of several linear and curvilinear features within the site that had been identified as cropmarks within the Aerial Investigation and Mapping Report (ES Appendix 6.2, Application Document 6.3). There was a strong correlation between the areas of cropmarks and the features revealed by the trenching.
- 4.2.189 The evaluation revealed a range of archaeological activity dating from the early Neolithic onwards. A single pit containing early Neolithic pottery and flint was recorded in the north-east corner of land parcel 30 and residual artefacts of the same date were also recovered from the same area. The evaluation revealed scattered evidence for Bronze Age and Iron Age settlement, predominantly from land parcel 30, but across all three parcels. This was represented by a low density of small ditches and discrete features with small quantities of finds dating to these periods, providing an indication of dispersed settlement and associated field systems through the later prehistoric period, although the limited size of the pottery assemblage and lack of diagnostic pieces has made it difficult to determine the periods of activity more precisely.
- 4.2.190 Rectilinear cropmarks indicating ditched enclosures around Heath Place and Hornsby Lane were confirmed to be Roman in date. The main phase of occupation took place from the early Roman period and peaked by the end of the 3rd century with little to no evidence that it continued into the 4th century. Evidence from Trenches 135 to 150 revealed that the activity was well-defined within the ditched enclosures, and concentrations of pits and postholes with associated finds assemblages clearly demonstrate domestic settlement. Evidence for associated industrial activities is limited, based on the artefact assemblages and environmental evidence, but trial trenching from Hornsby Lane to the south and east has shown that these enclosures were linked to both pottery production and agricultural economies. The rectilinear system of cropmarks to the north of the A13 are likely to be of Roman date and also

indicate a focus on an agricultural economy, but due to their peripheral location very few of these features provided reliable dating evidence.

- 4.2.191 Archaeological evidence for the post-Roman period was sparse and consisted of a single pit of early/middle Anglo-Saxon date in Trench 76, a medieval pit in Trench 104 and late medieval pottery from a ditch in Trench 114. During the post-medieval period, the site was almost entirely used for agricultural activity.
- 4.2.192 A large number of undated features were also recorded from across the different land parcels. These included three unurned cremation burials in Trench 136 but also many pits, postholes and ditches.

WSI A: Land Parcel 1

Introduction

- 4.2.193 Archaeological Trial Trenching of 49 trenches in land parcel 1 were completed between the 28 November 2019 and 6 December 2019.
- 4.2.194 Land parcel 1 is situated c 200m north of the hamlet of Orsett Heath within the county of Essex and Thurrock unitary authority (NGR TQ 63914 80335). The land parcel covers an area of 8.43ha that is bounded to the north by the A1013, to the east by both the Whitecroft care home and an open field, to the south by an open field, and to the west by Heath Road and the properties adjoining it.
- 4.2.195 The site is situated on an upland area and is relatively flat at 25m above Ordnance Datum (aOD), although it rises slightly to the north-west, up to 26m aOD along the A1013, and drops slightly towards the south end. The Mar Dyke valley lies 1.2km to the north-west, and this is the nearest large river to the site.
- 4.2.196 The land is currently in use as an arable field.

Anticipated Archaeological Potential

- 4.2.197 No known below-ground archaeological investigation has been undertaken previously at this location.
- 4.2.198 The site is situated within an area which is generally surrounded by multi-period complex cropmark sites, many of which are scheduled.
- 4.2.199 Aerial investigation within the site itself recorded a large number of 'pit-like' features and a north west to south west linear feature which was not as regular as the probable medieval or post-medieval field boundaries that were also identified.

Soils

- 4.2.200 The soil sequence varied across the site with a natural geology of silty sand and silty clay across the southern half of the site and a silty clay with patches of gravel across the northern part of the site. A nearby borehole from the British Geological Survey (BGS) along the A1089 (TQ68SW81 at 563710, 180200) indicates that the Boyn Hill Sand and Gravel extends c 4.5m below the surface in this area. This suggests that only the surface geology of Boyn Hill Sand and Gravel was encountered during this evaluation. The variation in the geology may have been influenced by the Lambeth Gravels which underlie the northern part of the site and the Thanet Sand which underlies the southern part of the site.

- 4.2.201 A thin subsoil layer (c 0.15m thick) of grey brown silty clay was encountered in eight trenches in the central and northern part of the site. This is likely to be the relict remains of a former plough soil which now lies below the depth of the modern ploughing.
- 4.2.202 The topsoil was a dark grey brown silty clay or silty sand which was 0.28-0.5m thick.

Summary of Results

- 4.2.203 Archaeological features were found in 14 trenches. Two of these trenches (trench 28 and 40) had three features that contained pottery which dates to the late Bronze Age. These features were located within the north-western part of the site.
- 4.2.204 The evaluation confirmed the presence of several linear features within the site, which had been identified as cropmarks by the aerial investigation and mapping report (Place Services 2019). The evaluation also indicated that many of potential features recorded through aerial investigation were naturally occurring and not of archaeological interest.
- 4.2.205 Three pieces of worked flint were recovered from the topsoil in trenches 14, 23, and 36; none of which is closely dateable.
- 4.2.206 Other than ground-truthing the existence of the post-medieval field boundaries, the evaluation identified four clusters/categories of archaeological features:
- 4.2.207 Field boundaries recorded through the aerial investigation were confirmed to be present. A prominent north north west to south south east aligned ditch (in trenches 43 and 26) is likely the same linear field boundary shown on the c 1840 Orsett Tithe map (D/CT 264/1a). A perpendicular west south west to east north east aligned ditch (in trench 27) is not shown on the 1840 map, but it respects the north north west to south south east ditch and is therefore likely to be roughly contemporaneous.
- 4.2.208 Three Bronze Age features (in trenches 28 and 40) and a further three undated pits were recorded (in trenches 27, 29, and 38) were recorded in the north west corner of the site; and
- 4.2.209 Four undated pits were recorded in the eastern side of the site (in trenches 20, 21, and 22); and
- 4.2.210 Two undated postholes in the south west corner of the site (in trench 6).
- 4.2.211 The low level of archaeological remains and artefactual evidence suggests that this site was subject to a low level of activity predominantly dating to the Bronze Age. This site may therefore be a peripheral location to more complex and intensive occupation areas within the immediate vicinity (such as within land parcel 3).

WSI B: Land Parcel 2

Introduction

- 4.2.212 Archaeological Trial Trenching of 41 trenches in land parcel 2 were completed between the 7 and 16 October 2020. Six trenches could not be excavated as planned due to access constraints.

- 4.2.213 Land parcel 2 is situated c 30m north of the hamlet of Orsett Heath within the county of Essex and Thurrock unitary authority (NGR TQ 564047 180101). The land parcel covers an area of 7.8ha that is bounded to the north and east by other agricultural fields, to the south by Hornsby Lane and houses and small fields north of Gowers Lane and to the west by scrubland and houses east of Heath Road.
- 4.2.214 The site is situated on an upland area and is gently sloped, with the southern edge at c 24-25m aOD sloping down to the north-east at 20-21m aOD. The Mar Dyke valley lies 1.6km to the north-west, and this is the nearest large river to the site.
- 4.2.215 The land is currently in use as an arable field.
- 4.2.216 The trenching layout was restricted in part due to a moderate potential for unexploded ordnance at this location, multiple services, and the presence of three badger setts.

Anticipated Archaeological Potential

- 4.2.217 No known below-ground archaeological investigation has been undertaken previously at this location.
- 4.2.218 The site is situated within an area which is generally surrounded by multi-period complex cropmark sites, many of which are scheduled.
- 4.2.219 No aerial investigation or geophysical survey data was available for this location, though linear features noted within neighbouring land parcels 1 and 3 may extend to within this site and trench placement has attempted to target this potential.

Soils

- 4.2.220 The soil sequence consists of natural geology of sand, overlain by a sandy silt subsoil, which in turn was overlain by ploughsoil.
- 4.2.221 The ploughsoil ranged between 0.18m and 0.38m thick and consisted of dark – mid brownish grey sandy silt and silty clay.
- 4.2.222 The subsoil deposits ranged between 0.12m and 0.30m thick across the site. The subsoil is likely to represent the remains of a former ploughsoil which now lies beneath the current ploughsoil.

Summary of Results

- 4.2.223 The evaluation did not record any features which extended from neighbouring land parcels (land parcels 1 or 3). It has been suggested that this land parcel has been more heavily ploughed and therefore these features have been truncated historically, or simply that the features shown as cropmarks do not continue into this area.
- 4.2.224 Archaeological features were identified in 17 trenches, with activity centred on a band running north west to south east across the centre of the land parcel and in the north of the site.
- 4.2.225 Five trenches contained only natural features and these were all tested with hand excavation.

- 4.2.226 A total of 19 trenches contained no features of any kind.
- 4.2.227 One early Neolithic pit was found in Trench 14 in the western part of the site, and one late Neolithic/early Bronze Age pit containing Beaker finds in the eastern half in Trench 27. These add to a pattern of dispersed early prehistoric activity on the gravel terrace identified from previous discoveries on the gravels in this area.
- 4.2.228 One pit containing later prehistoric (middle Bronze Age to early Iron Age) pottery was found in Trench 26, and two pits containing sherds only datable as prehistoric are also likely to be of later prehistoric date. Undated pits and ditches, including one curvilinear example, were scattered across the site, and many of these are also likely to be of prehistoric date, given the absence of later features or finds from the site.
- 4.2.229 No evidence of Roman or Anglo-Saxon activity was found, and only a single sherd of medieval pottery, although this was a rare continental import and thus of intrinsic interest. Post-medieval finds were sparse.
- 4.2.230 One north north west to south south east ditch in Trench 27 may well correspond to a boundary shown on the Tithe map of c 1840, although no continuation of this boundary was seen in Trench 41, which also crossed its line. It is likely that some of the undated ditches, particularly those on north north west to south south east or east north east to south west south alignments, may well be field boundaries of post-medieval date.

WSI L: Land Parcel 21

Introduction

- 4.2.231 Archaeological Trial Trenching of 116 trenches in land parcel 21 were completed between the 4 February and 18 March 2020. 12 trenches could not be excavated as planned, in part due to localised flooding.
- 4.2.232 Land parcel 21 is situated c 600m west north west of the hamlet of Baker Street within the county of Essex and Thurrock unitary authority (NGR 562736 181588). The parcel itself is roughly C-shaped and covers an area of 23.66ha. This land parcel is bounded to the west by agricultural fields and Springfield Cattery, to the north by Green Lane, to the east by further agricultural fields and Whitfields Farm and to the south by Stifford Clays Road.
- 4.2.233 This land parcel is situated on a slope on the southern side of the Mar Dyke valley. The Mar Dyke itself is located 1km north-west of the land parcel. The southern edge of the site is situated on the edge of a plateau where the terrace is at a height of c 21-24m aOD. The ground slopes downwards to the north and the lowest point of the land parcel is along the northern edge at 10-15m aOD. Colluvial deposits of head have accumulated along the slopes of the terrace and within the Mar Dyke river valley.

Anticipated Archaeological Potential

- 4.2.234 No known below-ground archaeological investigation has been undertaken within this land parcel.
- 4.2.235 The site is immediately adjacent to a scheduled monument comprising the Orsett (Grey Goose Farm) Cropmark Complex (NHLE 1002134). The Aerial Investigation and Mapping report (ES Appendix 6.2 (Application Document 6.3)) have identified a number of cropmarks within the southern portion of land parcel 21, which correlates with the edge of the gravel terrace. These cropmarks appear to extend southwards into the scheduled area.
- 4.2.236 Features identified through cropmarks include probable enclosure systems and two penannular ring ditches which are more likely to represent domestic enclosures than barrows as they appear to have entrances and are smaller in size. They may date to the later Bronze Age or Iron age.

Soils

- 4.2.237 The ploughsoil measured between 0.2 and 0.4m thick, the variation in depth resulting from mixed agricultural activities across the site. In parts of the site this overlay a thin subsoil layer. A thicker deposit of subsoil was recorded in the southeast portion of the site; in the lower lying trenches closest to Baker Street the subsoil was preserved up to 0.36m thick. The underlying natural geology changed from the Boyn Hill sand and gravels in the southern, elevated portion of the site to mixed head deposits of clay, silt, sand and gravel as the site descended to the north towards the Mardyke valley. No deep colluvial sequences were found on the site.

Summary of Results

- 4.2.238 Archaeological features were recorded in 46 of the 116 trenches excavated.
- 4.2.239 The predominant concentration of archaeological features was along the southern edge of the site, coinciding with the sand and gravel geology. This correlates well with the area of cropmarks identified through aerial investigation. Features recorded to the north of this area were limited to post-medieval field boundaries and possible Roman horticultural features.
- 4.2.240 Within the southern part of the site, the earliest activity was represented by a small assemblage of struck flint, which included pieces of Mesolithic or early Neolithic date and other tools of later Neolithic or early Bronze Age date. There were no features dated to these periods found in the evaluation. The only possible evidence for later Bronze Age activity was a single sherd of late Bronze Age or early Iron Age pottery, and none of the struck flints appeared to be of this date.
- 4.2.241 The enclosure ditches were found to date to the middle Iron Age, and although not directly dated, several penannular gullies are likely to be of similar date. In the late Iron Age to early Roman period settlement activity appears to have intensified at the site, and continued throughout the Roman period, though tailing off in the late Roman period; most of the pottery evidence came from enclosure ditches of middle Roman date. The remains of a Roman urned cremation were also recorded in Trench 96.

- 4.2.242 The evidence for the Iron Age and Roman periods should be considered in conjunction with the cropmarks visible south of Stifford Clays Road (land parcel 22), which show that this is part of the same settlement. The cropmark Roman enclosures investigated by Trenches 101 and 103 continue south of the road, and the western arm of the larger enclosure was also confirmed as Roman by trenching there. On the west side of the site, it seems likely that the Iron Age enclosure ditch crossing Trench 77 also continued south of the road, and was represented by a much broader cropmark, though this was not investigated by trenching there.
- 4.2.243 North of this lines of parallel slots, vertical-sided and flat-bottomed with deliberate backfills, some containing Roman pottery, were found running east-west in two parts of the field, and these may represent associated agricultural activity of Roman date.
- 4.2.244 No activity of Saxon or medieval date was found on the site. Post-medieval field boundaries were encountered in the north, central and south-eastern parts of the site, together with a post-medieval pit at the south-east end of the site.

WSI K: Land Parcel 22

Introduction

- 4.2.245 Archaeological Trial Trenching of 76 trenches in land parcel 22 were completed between the 15 January and 3 February 2020.
- 4.2.246 Land parcel 22 is situated c 70m west of the hamlet of Baker Street and 0.9km west of the village of Orsett. The site is located within the county of Essex and Thurrock unitary authority (centred on national grid reference TQ 62910 81217). It is within a scheduled monument, the area of which includes both land parcels 22 and 23 and covers an area of 17.16ha.
- 4.2.247 The site is bounded to the north by the Stifford Clays Road and to the east by the Grade II listed Baker Street Mill and associated land. The scheduled monument area itself extends further west than the Project but the site as described by the WSI extends westwards as far as a north north west to south south east aligned trackway. To the south the site extends as far as the A1089, but the scheduled monument extends further south, beyond the A13. The area between the A1089 and the A13 was already evaluated by the Grays by-pass excavation of 1979-80 (Wilkinson 1980, Site 2) and will not be subjected to trial trenching. The area to the south of the A13 will not be evaluated as this area has been heavily quarried.
- 4.2.248 The site is largely occupied by a single arable field with smaller paddocks along the eastern and western edges of the site. Within the 1km site buffer the land use is a mixture of agricultural land and urban development associated with the town of Grays to the south-west, and the hamlet of Baker Street to the east. The area has also been bisected by the A13, A1013 and the A1089, which have displaced the historical field boundaries.
- 4.2.249 This land parcel is situated on an upland area to the west of Orsett. The land parcel itself is located at the edge of a plateau with the highest elevations within the southern part at 27m aOD. This slopes down to 25m aOD at the northern edge of the site. A small stream is located within the western extend of the site just to the south of the Springfield Cattery (located north of Stifford Clays Road), which is perhaps suggestive of a spring line in this area. To the north of the site

the land drops gradually into the lowland area of the Mar Dyke valley and the river itself is located 1.3km north-west of the site.

Anticipated Archaeological Potential

- 4.2.250 The scheduled monument complex is on the Heritage at Risk Register 2019. The condition is noted as “generally unsatisfactory with major localised problems” and the principal vulnerability is from arable ploughing. The trend of the monument condition is declining, presumably from the attrition to buried archaeology from deep ploughing in arable fields (Historic England 2019). Parts of the scheduled area are also very likely to have been disturbed during the A13 widening in the early 1980s.
- 4.2.251 During the Baker Street excavation in 1979, several features dated to the late Bronze Age to early Iron Age were recorded within the southern part of the scheduled monument and site, near to the A1089 loop junction just north of the A13.
- 4.2.252 There is a high density of cropmarks within the site which are likely to relate to prehistoric occupation. This includes two small adjacent circular or penannular ring-ditches to the north, and two other small circular ring-ditches further south-west, any or all of which may represent later Bronze Age barrows (ES Appendix 6.2 sites 13, 14 and 15 (Application Document 6.3)).
- 4.2.253 The tithe and OS maps indicate the presence of a possible long-standing boundary within the western extent of the site. This boundary ran parallel with another, defining a thin land parcel that extended almost as far as the Mar Dyke to the north and down to the Stifford-Stanford Road to the south. It is possible these boundaries define a former droveway.

Soils

- 4.2.254 The soil sequence varied slightly across the site, with clayey sand and silt deposits containing high proportions of gravel. This suggests that only the surface geology of Boyn Hill Sand and Gravel was encountered for the most part, and that some of the geological variation within the site may be influenced by the variable bedrock geology, which includes Lambeth Group sand/silt/clay within the southern and eastern portions of the site, Harwich Formation sand/gravel across the central area, and London Clay Formation clay/silt/sand along the northern portion.
- 4.2.255 Subsoil deposits ranging between 0.05-0.4m thick were encountered across the site. The majority of these are likely to represent the relict remains of a former ploughsoil which now lies below the depth of the current ploughsoil.
- 4.2.256 The topsoil consisted of mid to dark grey brown sandy silt and clayey silt measuring between 0.28-0.4m thick.

Summary of Results

- 4.2.257 Archaeological features were recorded in 38 of the 76 trenches excavated. Activity was centred predominantly within the eastern half of the site, particularly the north-east corner. This accords well with the evidence provided by the cropmarks, though many of the discrete features mapped were found to be natural geology.

- 4.2.258 The fieldwork revealed some evidence for late Bronze Age to early Iron Age activity within the site, including the remains of a mostly complete large jar from a pit in Trench 36. Bronze Age and earlier Iron Age dating evidence was derived mainly from features within the northern part of the site, in the same general areas which also showed evidence for later occupation. The curvilinear ring-ditches encountered within the site remain undated, but it is possible that they may represent truncated and disturbed remains of Bronze Age barrows or other activity of this era.
- 4.2.259 The main phase of activity dates to the late Iron Age and Roman periods. The remains largely comprised field systems including enclosures, ditched boundaries and/or possible trackways. The associated artefactual assemblages indicate a varied range of activities being undertaken at, or at least very close to, the site with evidence of pottery production (kiln-related remains) iron working (smithing hearth bottoms), trade in salt and crop processing. These remains are likely to be part of a larger settlement represented by cropmarks to the north of Stifford Clays Road and evaluated as part of this project (land parcel 21).
- 4.2.260 It is likely that the activity is related to a farmstead site encountered previously during works in the 1980s, roughly 500m to the west of the site. This would imply that the late Iron Age and Roman features may have formed part of the agriculturally exploited hinterland of the farmstead settlement; the re-cutting of enclosure ditches suggests a level of stability and continuity over a considerable period of time.
- 4.2.261 Evidence for more recent field enclosure was present in Trenches 17, 23 and 30 with the poorly preserved line of a ditch corresponding to a boundary marked on the 1st Edition Ordnance Survey map.

WSI M: Land Parcels 24, 25, 26, 28 and 29

Introduction

- 4.2.262 Archaeological Trial Trenching of 146 trenches in land parcels 24, 25, 26, 28, and 29 were completed between the 19 and 20 March 2020 (land parcel 25), 11 August and 9 September 2020 (land parcels 26 and 28-29), and 11 and 14 May 2021 (land parcel 24). Fourteen trenches could not be excavated as planned.
- 4.2.263 The land parcels are located directly south-west of the hamlet of Baker Street and north-east of the suburbs of Grays within the county of Essex and Thurrock unitary authority (NGR 563334 180597). The site is bounded to the west by residential properties of the town of Grays and fields north of that, to the east by Baker Street and the A1089, and to the south by Gammonfields Way and the A1013 Stanford Road. The northern edge of the site is defined by the A1089 slip road and this road and the A13 also bisects the northern part of the site. The southern part of the site is bisected by Long Lane. The area available for investigation, excluding areas of services, hedgerows, and other constraints, was c 18.4ha.
- 4.2.264 The site has a mixed use, though the majority is used as arable fields and scrubland.

Anticipated Archaeological Potential

- 4.2.265 No known below-ground archaeological investigation has been undertaken within the site, but archaeological investigation has taken place along the line of the A13 adjacent to the north part of the site prior to and during its construction (Wilkinson 1988).
- 4.2.266 Land parcel 24, at the northern part of the site, is near the Orsett (Grey Goose Farm) Cropmark Complex scheduled monument. There are some further cropmarks, namely a partial potential enclosure ditch and various discrete features, within land parcel 24 which indicate a potential continuation of activity in this location.
- 4.2.267 Cropmarks identified during aerial investigation (ES Appendix 6.2, Application Document 6.3) also indicate a density of features within land parcel 28 including a potential ring ditch, a number of linear features orientated north west to south east and north east to south west. This set of cropmarks also includes potential smaller discrete features, and five sub-circular features up to 17m in diameter. The larger features may be bomb craters or quarry pits.

Soils

- 4.2.268 The soil sequence across the site was fairly uniform with a natural geology of either light reddish-brown sandy gravel, reddish-brown sandy clay, or yellowish orange silty sand. The natural that was encountered is the superficial deposits of the Boyn Hill Sand and Gravel, which covers the Lambeth Group clay, silt and sand deposits in this area.
- 4.2.269 A subsoil layer (generally 0.1–0.3m thick) of reddish-brown sandy silt was encountered in most trenches and this overlay the natural geology. This may be the relict remains of a former ploughsoil which has been eroded, probably by the modern ploughing. The subsoil and natural was overlain by a topsoil/ploughsoil which was a greyish brown sandy silt or silty sand that was 0.2-0.4m thick.

Summary of Results

- 4.2.270 Archaeological features were recorded in:
- eleven of the 16 trenches excavated in land parcel 24;
 - one of the four trenches excavated in land parcel 25;
 - two of the 16 trenches excavated in land parcel 26;
 - twenty-two of the 52 trenches excavated in land parcel 28; and
 - twenty-five of the 58 trenches excavated in land parcel 29.
- 4.2.271 Of the 80 interventions dug to the base of linear features, 51 were no more than 0.20m deep, and a further 25 no deeper than 0.40m. The predominately shallow depth of these and other features suggests that some degree of truncation has occurred on the site, most probably the result of modern ploughing.
- 4.2.272 The evaluation confirmed the presence of a circular cropmark ring ditch in land parcel 28, which contained much of a single vessel dated to the later Bronze

Age or (more likely) the early Iron Age. The absence of cremated remains may indicate that this ditch was more likely to have surrounded a roundhouse than to have originated as a burial monument. Two undated curvilinear gullies within 50m may have formed part of smaller enclosures. Small ring ditches were revealed in land parcel 24, along with a small number of other dated features: a pit and a ditch. Pottery dates these features to the late Bronze Age to early Iron Age period.

- 4.2.273 The cropmark ditch system aligned north north west to south south east by west south west to east north east in land parcel 28 was confirmed by evaluation, and was more extensive than indicated by the cropmarks, but had insufficient finds to date it. In land parcel 29 a further ditch system on the same alignments was found, one ditch containing a brick fragment of late medieval or early post-medieval date. This ditch was in line with one of the ditches in land parcel 28, and they were probably both parts of one wider field system. Some ditches corresponded with the extant western field boundary of land parcel 26, which a tithe map and early Ordnance Survey maps show was then part of a system of smaller fields to the north. The evidence suggests that evaluated ditch is a still earlier system of early post-medieval or (just possibly) late medieval origin.
- 4.2.274 A regular alignment of large, discrete cropmarks in land parcel 28 was shown to consist of natural features.

WSI P: Land Parcels 47 and 48f-h

Introduction

- 4.2.275 Archaeological Trial Trenching of 123 trenches in land parcels 47 and 48f-h were completed between the 13 August and 5 November 2021.
- 4.2.276 Land parcels 47 and 48f-h are situated along the east side of the Mar Dyke valley within the historic parish of South Ockendon in Thurrock unitary authority within the county of Essex (NGR TQ 62012 83241). The village of Orsett is located approximately 1.5km south-east of the site. The site is bounded by agricultural fields and covers an area of 38.38ha.
- 4.2.277 Land parcels 47 and 48f-h, are situated mostly in the floodplain of the Mar Dyke valley, with the exception of a promontory of higher and drier ground that extends eastwards from the west side of the valley into land parcel 48h. The western area of the site is located at 0-2m aOD with the eastern part of the site rising up to c 10m aOD.
- 4.2.278 The land is currently in use as arable fields.

Anticipated Archaeological Potential

- 4.2.279 No cropmarks have been identified within this area and finds have been very few. It is anticipated that as part of this area was the Mar Dyke fen, this was unsuitable for development or for agriculture. Cropmarks have been recorded around these land parcels, and these are those mapped within the Aerial Investigation and Mapping Report (ES Appendix 6.2, Application Document 6.3).

Soils

- 4.2.280 The soil sequence varied across the site but was broadly divided into two areas. The palaeochannels revealed deep sequences in excess of 3m comprising alluvial deposits of clay and peat horizons. The central and western part of land parcel 48 was undisturbed by palaeochannels and maintained a simpler sequence with the underlying geology of head or London clay overlain by a subsoil and then the ploughsoil. The subsoil was typically between 0.1m and 0.2m thick with a ploughsoil layer 0.3m thick.

Summary of Results

- 4.2.281 Archaeological features were recorded in six of the 123 trenches excavated. The small number of cut features were recorded in four trenches loosely grouped in the north east of land parcel 48h, which are positioned within the area of a meandering palaeochannel, and two trenches loosely grouped in the south east of land parcel 48h, which are on the promontory of higher ground.
- 4.2.282 The investigations revealed a series of palaeochannels meandering on an east to west alignment across the northern section of the investigation area, then looping around the eastern edge and returning along the southern edge of the site. These palaeochannels contained alluvial sequences in excess of 3m deep providing good conditions for the preservation of waterlogged plant and insect remains and pollen. The centre of the site, around which the palaeochannels had formed was a slightly raised promontory of head deposits, at a height of 4-4.5m aOD. To the west of this elevated area the topography sloped down to a height of approximately 3.1m aOD but no palaeochannels and only a thin layer of alluvium were seen on this side of the site.
- 4.2.283 On the southern edge of the raised promontory a dense scatter of 1254 worked flints, with diagnostic material of late Mesolithic date, was found, concentrated in Trench 86 and extending south into Trench 90. The assemblage included microburins, microliths and a tranchet axe/adze sharpening flake. A small quantity of early Neolithic pottery, representing at least six different vessels were also recovered from the top of the flint scatter in Trench 86, and some of the upper flints may also be of this date.
- 4.2.284 The remains of other flint scatters were recorded on the north and east edges of the promontory and floodplain in Trenches 20 and 72 respectively, and smaller groups of flint in most of the trenches along the north edge. Whilst these included a high proportion of blades suggesting later Mesolithic or early Neolithic technologies, some were also mixed with later prehistoric material.
- 4.2.285 Assessment of the borehole and trench transects identified two palaeochannel cuts on both the north and south sides of the promontory. The channel crossing Trench 14 on the north was radiocarbon-dated to the middle Bronze Age, while those on the south were dated to the early and middle Bronze Age. The character of the sediments filling both sets of channels and the wider floodplain thereafter, and the environmental evidence from the organic sediments and peats, was similar, and indicated a gradual silting of the channel system, becoming slow-flowing by the early Iron Age. Environmental evidence demonstrates increased clearance through to the middle Iron Age, with grazing throughout and possibly some arable agriculture in the late Bronze Age and Iron

Age. No evidence of marine transgression this far up the Mar Dyke river was found.

- 4.2.286 Few archaeological cut features were encountered. Two unurned cremations were found, in two dispersed locations (Trenches 6 and 90), and although without accompanying artefacts, charcoal from the cremation in Trench 6 was radiocarbon dated to the late Bronze Age. A scatter of pits, some containing charcoal, was also found, but no dating evidence. Later prehistoric sherds of pottery were recovered in small quantities from alluvial deposits or the surface of the natural in five trenches, one in land parcel 47 and the other four loosely grouped in the south-east of land parcel 48h, and part of a late Bronze Age, fired clay perforated plate from Trench 44.
- 4.2.287 In Trench 14 in the north-east part of the site a row of six waterlogged timber piles was found set within alluvial silt and traversing an east-west aligned palaeochannel. One of the timbers has been radiocarbon dated to the early Iron Age. The full extent of the structure is unknown at this stage but may have formed a footbridge across the channel.
- 4.2.288 Roman, Saxon/early medieval and medieval evidence is absent, although a widespread deposit of peat overlying the channels and thought to represent a phase of the Mar Dyke fen was dated to the mid-late Saxon period. No early post-medieval activity nor any drainage ditches were evident either, and, historic maps provide the first evidence for partial drainage of the fen after the canalisation of the Mar Dyke, probably in the 18th century, but as the maps make clear, the majority of the site remains fen throughout the 19th century.

WSI P: Land Parcels 48B and 48C

Introduction

- 4.2.289 Archaeological Trial Trenching of 157 trenches in land parcels 48B and 48C were completed between the 5 July and the 24 September 2021.
- 4.2.290 Land parcels 48B and 48C are located c 800m north west of the village of Baker Street in the historic parish of South Ockendon in Thurrock unitary authority within the county of Essex (NGR 561994 183659). Both land parcels are roughly rectangular, though land parcel 48C tapers to a point at its southern end. Together they cover an area of 29.71ha. These land parcels are bounded to the west and north by agricultural fields, to the east by further agricultural fields and to the south by Green Lane. An unmetalled north-south length of Green Lane also lies between the two land parcels.
- 4.2.291 The site is situated on a slope on the southern side of the Mar Dyke valley. The Mar Dyke itself is located 700m west of the land parcels. The southern edge of the site is situated on the southern river valley slope at a height of c 13m aOD, the ground sloping downwards to the north, with the lowest point of the site along its northern edge at c 5m aOD. Colluvial Head deposits have accumulated along the slopes of the river terrace and within the Mar Dyke river valley.
- 4.2.292 The land is currently in pastoral and arable use.

Anticipated Archaeological Potential

- 4.2.293 No known below-ground archaeological investigations have been undertaken within the site previously.
- 4.2.294 A number of linear cropmarks were identified during aerial investigation (ES Appendix 6.2 (Application Document 6.3)).

Soils

- 4.2.295 The ploughsoil typically measured between 0.2m and 0.45m thick, the variation in depth resulting from mixed agricultural activities across the site. Across much of the site this overlay a subsoil layer, measuring between 0.08m and up to 0.3m thick. Slightly thicker deposits of subsoil measuring up to 0.36m thick were also recorded in several trenches across the middle and southern part of land parcel 48B. Possible alluvial deposits were also recorded in Trenches 136 and 146 in the north of land parcel 48B, but nowhere else within the site. The underlying natural geology comprised London clay formation across the whole site and the superficial geology comprised a deposit of head clay. No colluvial sequences were found on the site, with the possible exception of a deposit in Trench 122 measuring 0.27m thick, which was overlain by ploughsoil and in turn overlay a 0.45m thick deposit of weathered London clay. No palaeochannels were thought to be present within the site and none were identified in any of the trenches.

Summary of Results

- 4.2.296 Archaeological features were recorded in 58 of the 157 trenches excavated.
- 4.2.297 These features were distributed across the site on the head clay deposits located on the southern slope of the Mar Dyke river valley with no particularly evident foci of activity.
- 4.2.298 The earliest activity was limited to two worked flints of Mesolithic origin. The occurrence of these artefacts in such small numbers suggests that activity during this period was little more than transitory.
- 4.2.299 The results suggest the site lay within the agricultural hinterland of the Iron Age and Roman settlement evaluated within land parcels 21 and 22 to the south, located on the high ground overlooking the southern slope of the Mar Dyke valley. Remains within the site principally comprised narrow, shallow cultivation or agricultural drainage ditches.
- 4.2.300 A number of these were broadly aligned north east to south west and north north east to south south west and others more or less perpendicular to these on north west to south east and west north west to east south east alignments. The majority of these features remain undated but are considered likely to be associated with the few examples from which late Iron Age - early Roman and Roman pottery was recovered. A series of other ditches in land parcel 48C share similar characteristics but are aligned more north to south. A single abraded sherd of Roman pottery was recovered from one ditch.

- 4.2.301 The evidence recorded in land parcels 48B and 48C should be considered in conjunction with the results from the evaluation of land parcels 21 and 22. This suggests that the present investigation probably represents the outer element of the core settlement's agricultural hinterland.
- 4.2.302 Post-medieval field boundaries were encountered in both land parcels, which were also evident in the cropmark data and on 19th century historic mapping.

WSI F: Land Parcels 41, 42, 44 and 60

Introduction

- 4.2.303 Archaeological Trial Trenching of 346 trenches in land parcels 41, 42, 44, and 60 were completed between 16 September and 28 October 2020 and between 25 May and 2 of July 2021. Four trenches could not be excavated as planned.
- 4.2.304 Land parcels 41, 42, 44 and 60 are located in the historic parish of North Ockendon in the London Borough of Havering and South Ockendon in Thurrock unitary authority within the county of Essex (NGR 559121, 183872). The majority of the southern part of the site is located within the historic parish of South Ockendon and the north-western part of the site (land parcel 41) is located in the historic parish of North Ockendon. The village of North Ockendon is adjacent to and north of the site, while the town of South Ockendon is adjacent to and south of the site. The site is roughly J-shaped and covers an area of 60.178ha. The site is bounded to the west by a branch line of the London, Tilbury and Southend Railway. To the south, east and north, the site is bounded by agricultural fields. Several houses are located directly north of the site along North Road (B186) which bisects the site. The site is also located just south-west of the site of North Ockendon Hall, now Hall Farm.
- 4.2.305 The land is currently in use as part of 12 arable fields located east and west of North Road (B186).

Anticipated Archaeological Potential

- 4.2.306 Several cropmarks of ring ditches were identified within the area of the site, including one within land parcel 41 and one within land parcel 60 (Place Services 2019; Site 6 and 5B). Several other features are also located within the southern part of the site, which is not being evaluated (land parcel 42), including several linear features and a semi-circular feature (ES Appendix 6.2 site 6 (Application Document 6.3)). While not dated, the character of the enclosures, particularly the penannular examples, suggests a later prehistoric date.
- 4.2.307 There are a number of linear cropmarks in the north of land parcel 41, which extend southwards from Hall Farm and may be associated with a medieval settlement at North Ockendon. This includes six linear features aligned north north west to south south east within the northern part of the site (ES Appendix 6.2 site 5B (Application Document 6.3)). These may be field boundaries of later medieval or early post-medieval origin, as apart from one they do not appear on the 19th century OS maps.

4.2.308 A medieval or post-medieval manor house is likely to have been located within land parcel 60, the easternmost part of the site and this is discussed in detail below. Documentary evidence also suggests that a post-medieval brick kiln was located within land parcel 41 in the western part of the site. Apart from the linear features within the site (which are likely to be of medieval and post-medieval date) there are also a number of discrete pit-like features and ring ditches that were identified from cropmarks within land parcel 60 (ES Appendix 6.2 site 5B (Application Document 6.3)). The ring ditches are likely to be prehistoric, although other dates including medieval and post-medieval are also possible; the cropmarks that has been identified within this area may prove to be prehistoric or medieval in date.

Soils

4.2.309 The soil sequence consisted of a mixed natural geology overlain by a relatively consistent layer of ploughsoil. In the southern part of the site there was a layer of subsoil below the ploughsoil and overlying the natural geology, but this was generally absent from trenches in the northern part of the site.

4.2.310 The ploughsoil comprised grey-brown clayey silt approximately 0.3m thick. The subsoil comprised greyish brown silty sand and clayey silt and was up to 0.25m thick. The thickest deposits of subsoil generally accumulated where dips in the topography occurred.

Summary of Results

4.2.311 Archaeological features were recorded in:

- a. Sixty-six of the 187 trenches excavated in land parcel 41;
- b. Six of the 27 trenches excavated in land parcel 42;
- c. Six of the 14 trenches excavated in land parcel 44; and
- d. Fifty-one of the 117 trenches excavated in land parcel 60.

4.2.312 The trenches revealed only sparse artefactual evidence for earlier prehistoric activity in the form of scattered struck flints of later Mesolithic or early Neolithic date and a single sherd possibly of Beaker or early Bronze Age date. Two large penannular cropmark enclosures potentially of earlier prehistoric date were targeted, and both revealed corresponding soilmarks; one was shallow and there were no finds, while the other was only minimally sampled as it was judged to be of natural origin.

4.2.313 Later Bronze Age or Iron Age activity was more prevalent, pottery of these periods being found both in pits and ditches, including a possible small rectilinear enclosure in the north-west part of the site, but some of the pottery was residual in later features. Further south, a group of ditches running east north east and containing later prehistoric pottery corresponded to a cropmark ditch, and probably relate to cropmark trackways or droeways and an enclosure outside the site to the west. The cropmarks of a ring ditch 15m across and a semi-circular larger enclosure may also be related, although the only dating evidence from them was a single struck flint. A few features contained definitely Iron Age pottery, including one example of an early Iron Age expanded rim.

- 4.2.314 Late Iron Age or early Roman pottery was found in ditches in several trenches in the north-west of the site, possibly peripheral to a focus beyond the site. In land parcel 60 west of the B186 a cluster of discrete cropmarks thought to represent pits, a ring ditch 10m in diameter and an arc of gully were targeted, but although the cropmark ring ditch was encountered and excavated, this did not contain dating evidence, and neither the arc of gully nor the discrete cropmarks that lay within the trenches proved to be genuine features. While the ring ditch may be later prehistoric, several arcs of curvilinear gully indicating enclosures of similar size were revealed in adjacent trenches, one of which contained a sherd of Roman pottery, and two ditches in neighbouring trenches possibly belonging to one system also contained Roman pottery, perhaps indicating a focus of early-middle Roman activity here. The paucity of finds suggests that this was not domestic in character. Later Roman activity was evident from a few sherds in the south-eastern part of the site, but otherwise Roman finds were sparse.
- 4.2.315 Evidence for Saxon activity was restricted to the east end of the site. A ditch in the north-east corner contained six sherds of Anglo-Saxon pottery, and another ditch in the far south-east of land parcel 44 produced another two sherds. Medieval activity was found in two main areas. In the northern part of land parcel 41, pottery recovered from field boundaries was dated to the late Saxon or Norman period. Clearer evidence of domestic activity here is evident in the 13th-14th centuries, with ditches and pits in several trenches along the north edge of the site that contained sizeable assemblages of domestic pottery and environmental remains including charcoal, cereals and weed seeds. Although no structural evidence was seen, this activity is likely to be very close to a focus of settlement of this date, probably the medieval manor and surrounding settlement of North Ockendon. In the south-east corner of land parcel 60, to the west of the B186, 13th/14th-century ditches may indicate a rectilinear enclosure.
- 4.2.316 At the western edge of land parcel 41, near to North Ockendon, two trenches revealed evidence for industrial activity dating to the 15th or 16th century. The precise nature of the industry is unclear, although the remains and field-name evidence indicate brick production from this period, with a possible brick clamp or kiln debris being recorded. Brick production at this location may have contributed to the construction of North Ockendon Hall.
- 4.2.317 In the post-medieval period, the site appears to have been used mainly for agriculture, with numerous boundary ditches and drainage features installed across the fields. Occasional ponds may have originated as localised quarries, or may indicate that part of the site was used as pasture.

WSI P: Land Parcels 43, 45A-E, and 46

Introduction

- 4.2.318 Archaeological Trial Trenching of 240 trenches in land parcels 43, 45A-E, and 46 were completed between the 9 September and the 29 October 2022. Twenty trenches were descoped from the original plan as they were no longer impacted by the Project.
- 4.2.319 Land parcels 43, 45A-E and 46 are located c 1km to the south-east of the village of North Ockendon and c 2.5km north-east of South Ockendon in the

historic parish of South Ockendon in Thurrock unitary authority within the county of Essex (NGR 561994 183659). Land parcel 43 is roughly rectangular in shape and 45A, triangular; the other land parcels, 45B-E and 46, are irregularly shaped. Together they cover an area of c 104.5ha. These land parcels are bounded to the north, east and south by agricultural fields and to the west by a mix of agricultural land and rough grassland.

- 4.2.320 The site is predominantly situated at the base of the Mar Dyke valley; the river flowing along the eastern boundaries of land parcels 45A-C and further to the east of land parcels 45D, 43 and 46, which lie on the slightly rising ground of its WNW valley slope. Land parcel 45D lies c 400m to the west, land parcel 46, c 650m to the west and land parcel 43 c 1.5km to the west of the modern water course. The lowest point of the site is situated almost in valley bottom at a height of c 4.0m aOD, the ground sloping upward to the west north west, to a high point at c 21m aOD.

Anticipated Archaeological Potential

- 4.2.321 No known below-ground archaeological investigations have been undertaken within the site specifically.
- 4.2.322 Two rectilinear cropmark enclosures, one only partially visible, and a system of linear boundaries probably representing a field system have also been identified in land parcels 46 and 45D. These enclosures are located on slightly higher ground just above the floodplain. Although currently undated, these may be of later prehistoric date, or alternatively may be Roman. There are also two parallel ditches aligned west south west east north east which run between two existing field boundaries and may be post-medieval field boundaries.
- 4.2.323 There is also a potential ditch and bank at the edge of the promontory to the east of land parcel 45C. The cropmark of a sinuous curving ditch following an irregular course was recorded as part of the aerial mapping survey 250m east of land parcel 45C which defines the western edge of a promontory and follows the topography of an area of higher ground. This feature can also be seen as an earthwork on LiDAR imagery, and it is therefore possible that a bank and a ditch may be present at this location. The feature may be defensive in nature or may just be an unusually shaped field boundary above the floodplain. This may be of prehistoric origin or of medieval to post-medieval origin.

Soils

- 4.2.324 The ploughsoil typically measured between 0.2m and 0.45m thick, although in several trenches it measured 0.12-0.15m thick and in several other examples up to 0.6m thick. The variation in depth is likely the result of mixed agricultural activities across the site. Across much of the site the ploughsoil overlay a subsoil layer, typically measuring between 0.07m and 0.3m thick.

Summary of Results

- 4.2.325 Archaeological features were recorded in 67 of the 240 trenches excavated.
- 4.2.326 The predominant concentration of archaeological features lay across much of land parcel 45D and the southern part of land parcel 46, and in a broadly north-south alignment through land parcels 45B and 45C. There were smaller clusters of features in the north of land parcel 46 and the east half of land parcel 43. Features predominantly comprised a combination of enclosure and field boundary ditches and gullies, pits, postholes, possible hearths and possible occupation deposits, along with several naturally derived tree-throw holes and a small number of natural features such as periglacial cracks. Where features were dateable, they ranged from the middle Bronze Age to Roman period and from the early medieval to post-medieval periods.
- 4.2.327 Alluvial deposits were widespread across the floodplain and floodplain margins in land parcels 45B and 45C, and in one trench on the edge of 45D. Archaeological remains were found beneath alluvium in land parcels 45B and 45D. In land parcel 45C Iron Age finds came from an alluvial layer, possibly indicating surface activity. With the exception of a very small residual flint assemblage no activity of earlier prehistoric date was recorded within the site. A pit containing much of a single middle Bronze Age vessel, struck flints, charcoal and charred grain was found in land parcel 45C. This was the only feature of this date identified.
- 4.2.328 A focus of late Bronze Age or early Iron Age activity was found in land parcel 46, centred on a ditch containing pottery, a flint core and flakes, part of a cremated human burial, fired clay and charcoal, with a possible hearth pit adjacent, both cut into a possible occupation layer. Similar finds were also recovered from adjacent trenches.
- 4.2.329 Several small areas of Iron Age activity were identified across the site, all at the edges of the evaluated area, so possibly adjacent to more substantial activity areas. Two areas, one in land parcel 45B, the other in 45E, contained groups of postholes and other features associated with Iron Age pottery and fired clay objects suggesting either domestic or agricultural structures. Others in land parcels 43, 45B and 45D had finds predominantly in parallel ditches, possibly indicating paddocks or cultivation trenches.
- 4.2.330 In the late Iron Age and Roman periods finds came predominantly from U-profiled cultivation trenches that occurred in patchy concentrations across the valley sides, though not all contained pottery. These are similar to others found on the southern slope of the Mar Dyke valley and in a tributary valley to the north-west, and represent a widespread local type in the Roman cultivation of the slopes of the Mar Dyke valley
- 4.2.331 A small but substantial cropmark rectangular enclosure in land parcel 45D was confirmed as medieval, the pottery assemblage indicating use from at least the 13th century to the 15th century. Post-medieval field boundaries corresponding with those depicted on historic maps and evident as cropmarks were recorded were identified in land parcels 43 and 45B.

WSI H: Land Parcels 40 and 49

Introduction

- 4.2.332 Archaeological Trial Trenching of 219 trenches in land parcels 40 and 49 were completed between the 22 September to 6 November and 19th May to 3rd September 2021. Three trenches could not be excavated as planned due to access constraints.
- 4.2.333 Land parcels 40 and 49 are located to the west of the village of North Ockendon and largely within the London Borough of Havering, though the extreme southern tip of land parcel 40 crosses into the Essex borough of Thurrock. The land parcels are located to the north and south of the junction between the M25 and the London, Tilbury and Southend railway, bounded by Thames Chase on the north and Dennises Lane on the south (NGR 558309 184574; NGR 558153 185456). Land parcel 49 lies west of the M25, mostly between the M25 and the railway, but a small part extends west of the railway and is bounded by Pike Lane. It ends at the Ockendon Road on the south. Land parcel 40 lies south of the B1421 Ockendon Road and is bounded on the west by Pea Lane, straddling the railway on the north and the M25 further south, where it ends at the line of the railway on the east.
- 4.2.334 The site is situated on the western slopes of a gravel plateau that is surrounded by the Mar Dyke valley on the north, east and south. At its eastern extent, the site lies at c 24m aOD and falls to c 18m aOD to the west. The ground is also lower-lying to the west, presumably due to the presence of another Pleistocene channel course. A tributary of the Mar Dyke River starts within this channel at Hobbs Hole, a pond located at the north edge of Parcel 49, crosses the Thames Chase Forest Centre just north of the site, and joins the main Mar Dyke river 2.6km to the north-east. A branch of the River Ingrebourne rises not far south of Hobbs Hole and runs north-west, then west and south-west to join the main river 4km away. A third stream rises just 1km south of the site and runs south-west towards the Thames.
- 4.2.335 The site was largely under arable cultivation at the time of fieldwork.

Anticipated Archaeological Potential

- 4.2.336 No known below-ground archaeological investigations have been undertaken within land parcel 49, though several investigations have been completed within the vicinity as part of the M25 widening scheme between 2008 and 2011 and includes a small area located immediately adjacent to land parcel 40.
- 4.2.337 No cropmarks were identified during aerial investigation within these land parcels (ES Appendix 6.2 (Application Document 6.3)).

Soils

- 4.2.338 The soil sequence in the trenches was fairly uniform. The natural geology of generally yellowish/orangish brown silty clay was overlain by a greyish brown sandy clay silt ploughsoil, c 0.15-0.58m thick. A greyish/orangish brown sandy silt subsoil, c 0.03-0.40m thick, was identified underlying the ploughsoil and overlying the natural in 86 trenches. Potential colluvial deposits were also recorded in Trench 13 in the north-west of the site.

Summary of Results

- 4.2.339 Archaeological features were recorded in:
- a. 47 of the 81 trenches excavated in land parcel 40; and
 - b. 63 of the 138 trenches excavated in land parcel 49.
- 4.2.340 The archaeological remains were largely found in low density and comprised ditches, pits, postholes and natural features such as tree-throw holes. Concentrations of features were revealed in the north, north-east and south-east of the site.
- 4.2.341 A microlith attests to definite Mesolithic activity on the site, and a small assemblage of early Neolithic struck flint, together with two sherds of early-middle Neolithic pottery, in the north-west part of the site, suggest activity here. A tree-throw hole contained an assemblage of flakes and scrapers and a utilised pebble dating to the Beaker/early Bronze Age period, indicating an activity area in the south-east part of the site. Two adjacent pits in the centre of land parcel 49, one containing a middle Bronze Age Bucket urn, the other a truncated upright vessel, indicate purposeful placed deposits. These were cut into a curving ditch. A pit containing late Bronze Age pottery was found at the south end of the site, and a ditch in the north-east corner of the site may also be of this date. A possible focus of early Iron Age activity was found either side of the railway line in the western part of land parcel 49, including a pit containing a near-complete vessel, and another possible focus that included middle Iron Age pottery at the south end of the site.
- 4.2.342 Evidence of Roman land use is restricted to small quantities of pottery and ceramic building material, most of which was residual in later features. The small assemblage is suggestive of background activity within the landscape, which may have been related to nearby settlement activity recorded at Manor Farm.
- 4.2.343 A few sherds of early/mid-Anglo-Saxon pottery indicate a background presence during that period. Activity increased during the medieval period, particularly c 1000-1400. A small number of ditches and pits were perhaps related to agricultural activity, with the pottery assemblages and charred grain indicative of nearby settlements. Medieval remains were concentrated in the west, north and south-east fringes of the site, the first suggesting a focus of activity located along the medieval precursor of Pike Lane adjacent to the site, which may potentially date from the late Saxon period. The last was sited adjacent to activity of 10th-12th century date revealed during earlier excavations during the widening of the M25. The activity to the north dates to later within the medieval period. An assemblage of medieval/post-medieval roof tile and brick also recovered from the northern and south-east areas may indicate that Tudor buildings were located nearby.
- 4.2.344 Late post-medieval/modern remains were revealed across the site in the form of ditches that correspond with field boundaries depicted on historic Ordnance Survey mapping and residual finds in overburden deposits. These remains are demonstrative of agricultural use of the landscape during this period.

WSI O: Land Parcels 54 and 126

Introduction

- 4.2.345 Archaeological Trial Trenching of 74 trenches in land parcels 54 and 126 were completed between the 17 August and the 30 September 2021 and the 9 September and the 1 October respectively.
- 4.2.346 Land parcels 54 and 126 are located c 1km east of Upminster in the historic parish of Great Warley, which has now been subsumed into the London Borough of Havering. Land parcel 54 is centred on NGR 559057, 186917 and land parcel 126 on NGR 558939, 186215. Both land parcels are irregular in plan; land parcel 54 broadly square with its western boundary tapering to the north and land parcel 126 broadly rectangular in its southern half. Together they cover an area of 21.59ha. Land parcel 54 is bounded to the north by St Mary's Lane, Clay Tye Road to the east, the soft estate of the M25 to the west and agricultural fields to the south. A tributary of the Mar Dyke river also flows between the two land parcels. Moving to the south, land parcel 126 is bounded by agricultural fields to the north, residential green space, dwellings and Clay Tye Road to the east, green space and light industrial units to the south, then woodland and green space to the west, adjacent to the M25
- 4.2.347 The site is situated on the lower slopes and in a tributary valley of the Mar Dyke basin and lies at a height of between 5m and 10m aOD. The site is currently in agricultural use; land parcel 54 is partly in pastoral use and serving as green open space, and 126 is in arable use.

Anticipated Archaeological Potential

- 4.2.348 No known below-ground archaeological investigations have been undertaken within the site.
- 4.2.349 During the M25 widening scheme a number of areas were excavated adjacent to the site. An unaccompanied later Bronze Age cremation was found, along with an undated ditch and a post-medieval ditch during the excavation of a pond to the north-west of land parcel 126. Six undated ditches and two undated postholes were also recorded during the excavation of another pond to the north-west of land parcel 54.
- 4.2.350 Essex County Council Field Archaeology Unit undertook two fieldwalking surveys adjacent to the wider site in 1998 and 2001. One, at Great Barn, located 0.4km west of land parcel 126 identified prehistoric and Roman finds.
- 4.2.351 No cropmarks were identified at this site during aerial investigation (ES Appendix 6.2 (Application Document 6.3)).

Soils

- 4.2.352 The ploughsoil measured between 0.1m and 0.5m thick, the variation in depth probably resulting from mixed agricultural activities across the site. In parts of the site this overlay a subsoil layer measuring between 0.04m and 0.26m thick. A 0.4m thick alluvial deposit was recorded in some of the low-lying trenches in land parcel 54. Colluvium was present in the northern portion of land parcel 126 and measured up to 0.45m thick.

Summary of Results

- 4.2.353 Archaeological features were recorded in 27 of the 74 trenches excavated.
- 4.2.354 The highest concentration of features was identified at the south end of land parcel 126, coinciding with an area of higher ground. Two distinct, and much smaller foci of features were also identified in the northern and southern parts of land parcel 54. Most of the features comprised a combination of ditches, and pits generally dated to the late Iron Age/early Roman and Roman periods; evidence for late Bronze Age/early Iron Age and medieval lower intensity activity was also recorded
- 4.2.355 The earliest activity was represented by a small assemblage of five struck flints of Mesolithic or early Neolithic origin and five pieces of burnt flint. Although very few, these occurred in three adjacent trenches at the south edge of the evaluated area, and so could indicate a wider area of activity in the vicinity.
- 4.2.356 The results of the evaluation suggest that the site lay close to an area of late Iron Age and Roman settlement. Remains within the site principally comprised medium-sized ditches, mostly forming a north-south and east-west system concentrated in the southern portion of land parcel 126. Some larger ditches may indicate more substantial enclosures. Scattered pits were also present, and the recovery of animal bones, charred plant remains and quern fragments as well as pottery, CBM and fired clay suggest that activity was not simply agricultural. Activity within the site noticeably decreased in the middle and late Roman periods.
- 4.2.357 Evidence of post-Roman activity was generally scant and corresponded with the higher ground area of intense Roman occupation in the central and south-eastern portions of land parcel 126. Features dated to this period comprised three ditches constructed on two different alignments: north east to south west and east-west. Post-Roman and medieval material comprised a single early/mid Saxon sherd and small assemblage of 11th to 12th century sherds. The site probably formed part of adjacent manors within Great and Little Warley and Cranham.
- 4.2.358 Post-medieval activity within site included a field boundary shown on 19th century historic mapping, and part of four fields belonging to Clay Tye Farm. The post-medieval and modern pottery recovered from site was probably related to agricultural activity such as manuring associated with this farm

WSI N: Land Parcels 55, 56, and 58

Introduction

- 4.2.359 Archaeological Trial Trenching of 165 trenches in land parcels 55, 56 and 58 were completed between the 7 September and 8 October 2020. One trench could not be excavated as planned due to ground conditions.
- 4.2.360 Land parcels 55, 56 and 58 are located north and south of Junction 29 of the M25 and north of the London, Tilbury and Southend Railway line. Land parcel 55 is located on the western side of the M25 within the London Borough of Havering. Land parcel 56 is situated on the eastern side of the M25 within the Borough of Brentwood in Essex. Land parcel 58 is located north of Junction 29 of the M25 and the London, Tilbury and Southend Railway line.

4.2.361 Land parcels 55 and 56 are located on the slopes of a plateau, falling from c 28m aOD at the north to c 8m aOD along the southern edge. Land parcel 58 is located on a plateau of higher ground north of the Mar Dyke valley at height of 36m aOD. Several streams pass in close proximity to the site, including one that runs past the east edge of land parcel 58 and continues alongside the M25 south of Junction 29 before turning south-east across the south side of land parcel 56. This is joined by a stream running west from Great Warley Hall, which skirts the north edge of the same land parcel. These streams feed into the Mar Dyke River located c 1km south-east of the site. The valley of the River Ingrebourne lies around 2km to the west.

4.2.362 Land parcels 55 and 58 were under arable cultivation at the time of fieldwork, whilst land parcel 56 was scrubland or rough pasture.

Anticipated Archaeological Potential

4.2.363 A single below-ground archaeological investigation is known to have been undertaken within the site boundary of land parcel 55. The Upminster Bund excavation (Biddulph and Brady, 2015) revealed a number of archaeological features, including a single unaccompanied cremation was found in the southern part of land parcel 55 radiocarbon-dated to 1270-1050 cal BC at 95% confidence. The cremation lay alongside an interrupted north west to south east pit alignment that contained fragments of late Bronze Age or early Iron Age pottery, although this pottery may have been residual (Biddulph and Brady 2015, 25).

4.2.364 No cropmark features have been identified within the Aerial Investigation and Mapping Report (ES Appendix 6.2, Application Document 6.3).

Soils

4.2.365 The soil sequence encountered within the trenches was fairly uniform. The natural geology of light to dark yellowish/reddish to greyish brown silty clay was overlain by a mid to dark brownish grey clay silt topsoil/ploughsoil, c 0.20-0.46m thick. A mid orangish/greyish brown silty clay subsoil, c 0.05-0.32m thick, was identified underlying the ploughsoil and overlying the natural in approximately a quarter of trenches distributed across the site.

4.2.366 Areas of modern made ground of mixed deposits were recorded in seven trenches located in the west of the site.

Summary of Results

- a. Archaeological features were recorded in:
- b. fourteen of the 31 trenches excavated in land parcel 55;
- c. fifty-five of the 86 trenches excavated in land parcel 56; and
- d. two of the 26 trenches excavated in land parcel 58.

4.2.367 The trenches overall contained a low density of archaeological remains comprising ditches, pits, postholes and natural features such as tree-throw holes. Slight concentrations of features were revealed in the east of the site within land parcel 56.

- 4.2.368 A small quantity of worked flint of Mesolithic/Neolithic date provides a limited and perhaps transitory presence in the wider landscape during the earlier prehistoric period. A small number of pits and a ditch containing middle Bronze Age to early Iron Age pottery provide further evidence of low-level prehistoric activity on site and within the surrounding landscape.
- 4.2.369 Evidence of Roman activity is limited to two pits in the east of the site, within the north of land parcel 56, though they contained relatively large quantities of Roman pottery. The majority of this pottery dates to the late Roman period, though residual pottery of early-middle Roman date is also represented. These remains are suggestive of activity that may have been related to Roman settlement and agricultural activity encountered immediately to the north at Hobbs Hole.
- 4.2.370 Evidence of late Saxon and medieval activity was largely concentrated in a small number of trenches located in the east of the site towards the north of land parcel 56. Small quantities of 10th- to 14th-century pottery were recovered from a few ditches and pits. It is probable that they were related to agricultural activity associated with nearby settlement.
- 4.2.371 Late post-medieval/modern remains were revealed across the site in the form of ditches that correspond with field boundaries depicted on historic Ordnance Survey mapping, and residual finds in topsoil deposits. These remains are demonstrative of agricultural use of the landscape during this period.

5 Research agenda and frameworks

- 5.1.1 The National Policy Statement for National Networks (Department for Transport, 2014) states in paragraph 5.140 that, where the loss of the whole or part of a heritage asset's significance is justified, the applicant will be required to '*record and advance understanding of the significance of the heritage asset before it is lost.*'
- 5.1.2 Advancing understanding is achieved through reference to the value of the heritage asset and the potential contribution the asset makes to the historic environment research agenda.
- 5.1.3 Research relevant to the Project includes:
- a. East of England Regional Historic Environment Research Framework (Association of Local Government Archaeological Officers East of England and Historic England, 2000; 2011; 2017)
 - b. Greater Thames Estuary Historic Environment Research Framework (Greater Thames Estuary Archaeological Steering Committee/Historic England, 2010)
 - c. Research Framework for London Archaeology (Historic England Museum of London 2002)
 - d. South East research Framework (East Sussex/Kent/Surrey/West Sussex/Historic England, 2007/2019)
- 5.1.4 Additionally, the Scheme-wide Written Scheme of Investigation for Trial Trenching south of the River Thames and the Scheme-wide Written Scheme of Investigation for Trial Trenching north of the River Thames (Application Document 6.3, Appendices 6.11 and 6.12) identified specific research questions.
- 5.1.5 The relevant research agenda, Scheme-wide Written Schemes of Investigation, desk-based studies, geophysical surveys and the results of the archaeological trial trenching are used to develop specific research questions for the Project in consultation with key stakeholders and relevant experts.
- 5.1.6 Each Site Specific Written Scheme of Investigation (SSWSI) of areas of archaeological interest prepared in accordance with the Draft Development Consent Order Requirement 9 (Application Document 3.1) will clearly identify research objectives developed, and approaches which will contribute to meeting those objectives.
- 5.1.7 The Project will set up the Lower Thames Crossing Heritage Research Group which will develop the research aims and objectives across the whole Project. This group will include academics and researchers, commercial archaeologists, Local Authority Archaeological Advisors and Historic England.
- 5.1.8 Professor Timothy Darvill from the University of Bournemouth has agreed to chair the Group. Professor Darvill is a prehistorian with a strong international public profile. He leads research projects and publishes widely on the

archaeology of early farming communities in north-west Europe, and on archaeological resource management. He has undertaken pioneering research into the history and development of Stonehenge and other related Neolithic monuments.

6 Strategy for archaeological mitigation

6.1 Introduction

- 6.1.1 In accordance with National Policy Statements, National Planning Practice Guidance and DMRB, the design of the Project has been developed to mitigate impact upon archaeological remains: the impact of the Project has been minimised or avoided where possible. In accordance with DMRB, priority will be given to the preservation of archaeological remains within the Order Limits. Where avoidance of remains is not possible, measures will include protection of remains within working areas, preservation of archaeological remains that are required to be covered over temporarily (e.g. in compound areas or beneath temporary roads), and preservation of archaeological remains that will be permanently covered beneath shallow fill.
- 6.1.2 Where archaeological remains are within the footprint of the Project, including areas of other environmental mitigation and utilities diversions, a comprehensive programme of archaeological fieldwork and recording will be implemented. This will include detailed archaeological excavation, recording, reporting, publication, and dissemination to local communities, the wider public and academics. The archaeological mitigation programme will address the Research Agenda (see Section 5 above) and will be undertaken to the highest practicable standards, employing innovative data collection approaches and techniques.
- 6.1.3 The question-led approach will aim to contribute to archaeological research and understanding to mitigate the loss of archaeological remains through advancing understanding of their significance.

Scope of archaeological mitigation

- 6.1.4 The archaeological mitigation requirements will apply (to the extent necessary) to the areas and works required for the Authorised Development (as defined in the DCO), including utility diversions, highway works on side roads, works on land temporarily possessed, protective works to buildings within the Order Limits or which may be affected by the Authorised Development, surveys and investigations on or adjacent to land within the Order Limits, and felling or removing trees or hedgerows or cutting back their roots and any ancillary works, or other works authorised by the DCO requiring an archaeological response (including industry standard practice and control measures for environmental impacts arising during the relevant works).

Phasing of archaeological mitigation

Preliminary works

- 6.1.5 Preliminary works would take place in the phase between the DCO being granted and the commencement of construction. Commencement is formally defined in the Draft Development Consent Order (Application Document 3.1). A definitive list of the activities that could be undertaken during the preliminary works phase is provided in the Code of Construction Practice, First iteration of Environmental Management Plan (Application Document 6.3, Appendix 2.2).

- 6.1.6 Archaeological work taking place during this phase takes three forms:
- the investigation of a limited number of areas where access issues prevented full assessment, for example the Southern Valley Golf Course. This will include non-intrusive and intrusive techniques.
 - a programme of Palaeolithic and Holocene intrusive fieldwork and specific geophysical techniques designed to aid the interpretation of the fieldwork
 - archaeological mitigation of other activities carried out as preliminary works.
- 6.1.7 Preliminary works activities that have the potential to impact on heritage assets comprise pre-construction ecological mitigation (including vegetation clearance), environmental surveys and monitoring, investigations for the purpose of assessing and monitoring ground conditions and levels, erection of any temporary means of enclosure, receipt and erection of construction plant and equipment for advanced compound areas, diversion and laying of underground apparatus (except any excluded utilities works) for advanced compound areas, vegetation clearance and accesses for advanced compound areas. The Preliminary Works REAC within the Code of Construction Practice, First iteration of Environmental Management Plan - Annex C - Preliminary Works Environmental Management Plan (ES Appendix 2.2) (Application Document 6.3) includes the commitment to implement this AMS-OWSI which will ensure that the impact of any such preliminary works on any heritage asset, including buried archaeological remains, is mitigated.

Main works construction

- 6.1.8 Most of the archaeological mitigation work will take place in the main works construction phase prior to or concurrent with the start of the earthworks phase in each area.
- 6.1.9 The main works construction phase includes initial works, highways works, tunnel works, routes for walkers, cyclists and horse-riders, utilities works and further environmental mitigation. Further details can be found in ES Chapter 2: Project Description (Application Document 6.1).
- 6.1.10 These works have the potential to impact on heritage assets, including buried archaeological remains, and they will be carried out in accordance with appropriate SSWSIs and MSs following the strategy described in this AMS-OWSI.
- 6.1.11 Archaeological work taking place during the main works construction phase will include all the mitigation techniques set out in Table 3.1 and discussed in detail in Chapter 7.
- 6.1.12 Preservation of archaeological site through fencing or sealing will also take place during the initial works stage.

6.2 Archaeological mitigation and construction activities

- 6.2.1 Different elements of the Project will require a different approach to archaeological mitigation, as summarised below; the mitigation approaches are outlined in Chapter 6 below and in Table 3.1.

- 6.2.2 SSWSIs will set out in detail the research aims and objectives and the relevant mitigation measures for the detailed design of the Project, informed by the results of the archaeological trial trenching and the desk-based studies, and will be based upon the strategy described in this dAMS-OWSI. Existing models and new datasets collected during the fieldwork will be used to model deposit sequences to inform design of archaeological mitigation works in the SSWSIs, during the investigations (part of the on-site iterative process) and during the assessment and analysis stages.
- 6.2.3 SSWSIs will be prepared in consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors) and, where appropriate, Historic England.

Construction work and cultural heritage

Initial works

- 6.2.4 Initial works form part of the main construction works and take place following the commencement of construction. Initial works are those that prepare the site and the compounds for the main construction activity. These works would cover the following activities to allow construction to begin:
- The early stages of ecological mitigation, such as preparing habitats and moving species (these works may start as part of preliminary works and would also continue through later phases of construction)
 - Securing the construction sites, including diverting or closing temporary public rights of way
 - Creation of haul roads
 - Establishing the construction compounds and ULHs, including utility diversions and connections
- 6.2.5 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.6 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Highways Works

- 6.2.7 Construction methods typically associated with major infrastructure projects would be implemented to construct the proposed roads and highways, as detailed further in this section. A selection of those construction activities most likely to impact on heritage assets are set out below.

Topsoil removal

- 6.2.8 Topsoil removal is one of the first stages for construction, which involves stripping the top layer of soil, typically to a depth of 0.25m.
- 6.2.1 Its removal would be necessary from various areas, including:

- a. the main construction worksites
- b. utilities works sites
- c. temporary construction site areas, including compounds and ULHs
- d. temporary haul roads and temporary construction working areas.

6.2.2 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal.

6.2.3 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Temporary soil and topsoil storage areas

6.2.4 Soil storage areas would be used to temporarily stockpile the fill material that would be either imported from an outside source or generated onsite through cutting operations. Prior to using these areas for storing the fill material, topsoil would be stripped off and transported to the designated topsoil storage areas. Soil storage areas would then be bounded by appropriate fencing where required.

6.2.5 These activities have the potential to damage buried archaeological remains and other heritage assets through compaction or compression, but also may provide an opportunity to preserve buried archaeological remains through burial or sealing.

6.2.6 Where this occurs an appropriate mitigation technique has been identified for the sites affected

Earthworks

6.2.7 The construction of earthworks, such as cuttings and embankments, mostly involves filling (i.e. building up the ground level) and cutting (i.e. excavating). This would be carried out after stripping and storing the topsoil for reuse. The formation level of the pavement can then be built at the required level.

6.2.8 Soil and other material for embankments would be brought to the site using heavy machinery, and then added in layers and compacted. Cutting would involve excavating and shaping using excavators.

Filling

6.2.9 Construction of embankments by filling would involve sourcing and using fill material and raising the profile of the ground to the road formation level. This enables the construction of the design item, such as a road pavement or footpath, to be based on the embankment.

6.2.10 These activities have the potential to damage buried archaeological remains and other heritage assets through compaction or compression, but also may provide an opportunity to preserve buried archaeological remains through burial or sealing.

6.2.11 Where this occurs an appropriate mitigation technique has been identified for the sites affected

Cutting

- 6.2.12 To construct a cutting, the ground is excavated to road formation level. This enables the construction of the design item, such as a road pavement or footpath, to be based within the cutting.
- 6.2.13 Construction of cuttings would involve excavating soil and shaping slopes using suitably sized excavators with hydraulic attachments.
- 6.2.14 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.15 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Management of spoil/excavated material and earthworks

- 6.2.16 As a result of excavating the tunnels and preparing the ground, the construction of the Project would generate a large amount of excavated material, such as earth and rock. Managing this excavated material, and reusing it for earthworks, would play a significant role in reducing the amount of construction traffic using the road network to transport this material to worksites at any given time.
- 6.2.17 These activities have the potential to damage buried archaeological remains and other heritage assets through their, compaction or compression or changes to their setting. Additionally, the scale and nature of some of the landscaping means that the significance of any archaeological remains will be permanently lost as future study would be impossible.
- 6.2.18 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Temporary works for structures

- 6.2.19 The construction of the various structural elements (such as under- or overbridges, support to deep excavations, and crane or piling pads) would require several differing temporary works systems.
- 6.2.20 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.21 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Site lighting

- 6.2.22 During all construction packages, temporary construction compounds and working areas would typically be lit during hours of darkness to provide a safe and secure working environment, when required.
- 6.2.23 These activities have the potential to damage heritage assets through temporary changes to their setting.
- 6.2.24 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Drainage

- 6.2.25 The Project would require the installation of drainage systems to manage and treat surface water when the road and tunnel is operational and during the construction phase to minimise the impact of runoff on the surrounding environment.
- 6.2.26 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.27 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Flood compensation

- 6.2.28 Flood compensation would typically be built ahead of works in the floodplain. It involves lowering the finished ground level to store flood water.
- 6.2.29 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.30 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Structures

- 6.2.31 Structures will be constructed including bridges, viaducts, retaining walls gantries and signage.
- 6.2.32 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.33 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Tunnels Works

- 6.2.34 The Lower Thames Crossing would take the form of twin-bored 4.25km (2.6 mile) tunnels crossing beneath the River Thames, one for southbound traffic and one for northbound traffic. The tunnel bores would be constructed from the north of the River Thames southwards utilising two separate TBMs.
- 6.2.35 To connect the deep bored tunnel to the surface-level highway, approach ramps would be constructed.
- 6.2.36 At the North Portal, the deeper part of the approach ramp would be excavated first so that the TBMs can be lowered into the excavation to start tunnelling. Following this, the cut and cover section would be constructed, through construction of a structure to form a section of tunnel which is then buried. As the cut and cover section rises to meet ground level, the excavation is left open and formed into a cutting. The road would continue to rise following the ramp, becoming shallower until it eventually meets ground level.
- 6.2.37 The launch structure at the North Portal would be a large excavation, with a concrete base and walls, supported by steel props. This box structure would

provide a solid base on which to assemble the TBM, and a firm support against which pressure would be applied to push the TBM forwards. The box structure would be open during tunnelling activities and then incorporated into the cut and cover tunnel.

- 6.2.38 At the South Portal, the tunnel would emerge into a deep cutting that leads southwards towards the M2/A2/A122 Lower Thames Crossing junction. The cutting work at the South Portal would involve the excavation of mostly chalk material. A deep excavation would be needed to build the section of road between the new M2/A2/A122 Lower Thames Crossing junction and the tunnel.

Walkers, cyclists and horse riders (WCH)

- 6.2.39 The construction of the Project would require permanent diversion or closure of WCH routes, include existing footpaths, shared use routes for pedestrians/cyclists and existing bridleways.
- 6.2.40 Some footpaths, shared use routes for pedestrians/cyclists, and bridleways would be rerouted permanently as part of the proposals, and may be subject to upgrade, diversion, extension or redesignation. New footpaths, shared use routes for pedestrians/cyclists and bridleways are also proposed, which would link up with the existing network.
- 6.2.41 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.42 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Utilities works

- 6.2.43 The utilities works to divert or protect existing assets or provide connections for construction are expected to start early in the construction programme and would coincide with initial works, including undertaking some of the utility diversions and the required connections for the site compounds. Other utilities works would be undertaken during the main works construction activities.
- 6.2.44 Utility diversion works can be classified as follows:
- a. Offline diversions – These would be required where construction activities would otherwise impact on the asset or the adjacent road network, where the asset cannot be accommodated within the new proposed alignment or structure for safety or operational reasons.
 - b. Online diversions – These would be required where construction activities would otherwise impact environmental receptors, buildings, landowners or railways, or would impede the utility network owner's ability to maintain supplies to their customers. The asset would be located within the highway alignment or structure for mitigation or operational reasons.
- 6.2.45 Temporary Utility Logistic Hubs and access routes will be created to support the utilities work.

- 6.2.46 Construction methods typically associated with major infrastructure projects would be implemented for the utilities works.
- 6.2.47 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.48 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

Environmental mitigation and compensation

- 6.2.49 Measures have been embedded into the Project design to mitigate adverse impacts arising from the operation of the Project on the environment and surrounding communities.
- 6.2.50 These include acoustic measures, habitat creation, enhancement and landscaping measures, air quality measures and drainage and water environment measures.
- 6.2.51 These activities have the potential to damage buried archaeological remains and other heritage assets through their whole or partial removal, compaction or compression or changes to their setting.
- 6.2.52 Where this occurs an appropriate mitigation technique has been identified for the sites affected.

6.3 Archaeological mitigation by construction zone

- 6.3.1 The Project construction site has been split into four construction sections (Sections A to D). Construction Sections A to D have then been further divided into activities for the purposes of managing the construction process.
- a. Section A: South of the River Thames: Covering the area of the A2/M2 corridor, the proposed M2/A2/A122 Lower Thames Crossing junction and highways up to, and including, the proposed Thong Lane green bridge north over the A122.
 - b. Section B: A122 Lower Thames Crossing Tunnel: Covering the area from north of the Thong Lane green bridge north to the southern end of the proposed Tilbury Viaduct structure. This includes the areas required for above and below ground construction of the tunnel.
 - c. Section C: North of the River Thames: Covering the area from the southern end of, and including, the proposed Tilbury Viaduct up to, and including, Green Lane, north of the proposed A13/A1089/A122 Lower Thames Crossing junction.
 - d. Section D: North of the River Thames: Covering works north of Green Lane to the M25 corridor, extending beyond M25 junction 29.
- 6.3.2 For the purposes of this dAMS-OWSI each individual Heritage Asset impacted by the Project has been identified by Construction Zone and an appropriate mitigation type proposed. These are set out in Table 9.1, Table 9.2 and

Table 9.3 and the Heritage Assets are shown on Chapter 6: Cultural Heritage, Figures 6.1, 6.2, 6.3, 6.8 and 6.9.

Section A construction activities

Preliminary works

- 6.3.3 There is a potential for ecological mitigation to take place as preliminary works within Section A. All preliminary works will be subject to archaeological mitigation if required. This will be secured through the Preliminary Works REAC and the AMS-OWSI.
- 6.3.4 Preliminary works will also include a small number of archaeological trial trenches on the site of the A2 compound, part of which was not investigated as land access was not available. Other archaeological investigation within the preliminary works phase in Section A will include a programme of Palaeolithic and Holocene intrusive fieldwork and specific geophysical techniques designed to aid the interpretation of the fieldwork.

Initial works

- 6.3.5 Initial works in Section A will include setting up the construction compounds including utility diversions and connections of the A2 Compound. This will affect Heritage Asset 1820. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.6 The site of the A2 Compound was not trial trenched as access was not made available, mitigation of the remainder of the compound could be informed by a small number of trial trenches excavated during the preliminary works stage.
- 6.3.7 Haul routes will be constructed across the Project. This will affect Heritage Assets 677, 1821 and 3650. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

Utility works

- 6.3.8 Three temporary Utility Logistic Hubs (ULHs) and associated access routes are being created in Section A. The A2 West ULH will affect Heritage Assets 677, 1459, 3640 and 3643. The A2 East ULH will affect Heritage Asset 3658. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.9 The Park Pale Lane ULH will not affect any known heritage assets, but as no archaeological trial trench took place in the area archaeological monitoring and recording is proposed during the construction of the ULH.
- 6.3.10 Utilities access will affect Heritage Assets 677, 1459 and 3650. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.11 A new electricity compound containing a new electricity substation and switchgear equipment constructed near the A226 (Work number MU21). This substation would be connected to the existing Northfleet grid substation at the B262 Hall Road via a cable approximately 8.6km in length (Work numbers MU15 to MU17 and MU19), to be installed as part of the Project along the A2

Roman Road, Hever Court Road and then north heading along the WCH routes on the western side of the A122 to the A226.

- 6.3.12 These works will affect Heritage Assets 1302, 1306, 1680 and 3185. In addition, MU15 crosses two potential dry valleys near Wrotham Road. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.13 A Southern Gas Networks gas pipeline (Work numbers G1a and G1b) and two National Grid gas pipelines would (Work numbers G2 and G4) need to be diverted.
- 6.3.14 Most of the pipeline diversion would be installed using normal open cut trenching techniques. However, due to the small footprint of land to the west of Thong Lane and the depth of the pipelines relative to the existing ground level four shafts and two joining tunnels will be constructed.
- 6.3.15 These works will affect Heritage Assets 677, 3641, 3642, 3644, 3650, 4558, and 4596. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.16 There are further multiple diversions along the northern edge of the existing A2, these include Work numbers MU1, MU10, MU11, MU13, MU14 and MU16. These works will affect Heritage Assets 1331 and 1787. In addition, MU1 crosses a dry valley to the east of Pale Park Farm. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

Offline works north of the A2/M2

- 6.3.17 This activity relates to the construction of the Project between the A2/M2 junction and the Thong Lane green bridge north, the construction of two viaducts: Gravesend East to the M2 eastbound viaduct and the A122 southbound to the A2 westbound viaduct, and the Thong Lane Green Bridge.
- 6.3.18 A significant amount of this activity involves earthworks associated with the deep cutting between the proposed M2/A2/A122 Lower Thames Crossing junction and the South Portal. There would also be a false cutting along the M2/A2/A122 Lower Thames Crossing junction slip roads near Thong village.
- 6.3.19 Construction of Section A extends to the Thong Lane green bridge north, where the cutting would be excavated to a depth of 8m and around 80m wide.
- 6.3.20 These works will affect Heritage Assets 677, 1459, 1515, 1598, 3644, 3650, 3658, 3667, and 4596. In addition, a dry valley known to contain Upper Palaeolithic deposits to the west cross the area of deep cutting. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

Gravesend East Junction

- 6.3.21 At the Gravesend East junction, construction works would include modifications to the junction, including an upgrade to the existing roundabout, widening an existing bridge, and changes to existing utilities in the area.
- 6.3.22 The works to upgrade the roundabouts would involve building retaining walls, carrying out earthworks, widening roads and upgrading lighting.

- 6.3.23 This work is unlikely to have any impact on buried archaeological remains or other heritage assets.

Connector roads around the A2/M2

- 6.3.24 These works would include modifications to existing roads and the construction of new connector roads and bridges.
- 6.3.25 A new green bridge is proposed over the A2/M2 at Thong Lane. As the new bridge has been designed on a different alignment to the existing one, the existing bridge would not require demolition until the new structure is in place.
- 6.3.26 The new Brewers Road green bridge would be built on the same alignment as the existing bridge as this would need to connect directly to the existing HS1 green bridge immediately to the south.
- 6.3.27 Other works associated with the connector roads around the A2/M2 would include the link roads between the new A122 and the A2 westbound, local roads between Henhurst Road roundabout and Thong Lane and Brewers Road roundabout, and sections of the Thong Lane green bridge south, and the Brewers Road bridge.
- 6.3.28 Cobham service station would be closed early in the construction programme. Some decontamination activities may be needed, but this would not be confirmed until the tanks under the concrete have been checked for leaks or seepage. Once assessed, the tanks would be removed. Works would then begin to build a new roundabout involving the demolition of the existing petrol station, vegetation clearance, earthworks, new retaining walls and a bridge. New utilities would also be diverted into this area.
- 6.3.29 These works will affect Heritage Assets 1302, 1306, 1324, and 2512. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

A2/M2 corridor works

- 6.3.30 The A2/M2 would be widened adjacent to the proposed M2/A2/A122 Lower Thames Crossing junction. This would include adding a fourth lane of the M2 through junction 1, and additional lanes in both directions running parallel to the A2 to provide connections to the A289 and the A2.
- 6.3.31 This work is unlikely to have any impact on buried archaeological remains or other heritage assets.

Environmental mitigation and compensation

- 6.3.32 Planting and landscaping would be undertaken as necessary in accordance with the Outline Landscape and Ecology Management Plan (Application Document 6.7), secured by Requirement 5 of the Draft Development Consent Order (Application Document 3.1) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.
- 6.3.33 These works will affect Heritage Assets 677, 762, 1331, 1398, 1454, 1599, 1998, 3535, 3640, 3642, 3643 and 3655. Additionally, the nitrogen deposition compensation sites close to Kit's Coty, Burham and Blue Bell Hill, have the

potential to affect Heritage Assets 4745, 4483 and 4513. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

Section B construction activities

Preliminary works

- 6.3.34 There is a potential for ecological mitigation to take place as preliminary works within Section B. All preliminary works will be subject to archaeological mitigation if required. This will be secured through the Preliminary Works REAC and the AMS-OWSI.
- 6.3.35 Preliminary works will also include archaeological trial trenching in two areas where this was not possible before submission. These include the Southern Valley Golf Course and to the north west of the golf course in the area bounded by Thong Lane and Rochester Road. Other archaeological investigation within the preliminary works phase in Section A will include a programme of Palaeolithic and Holocene intrusive fieldwork and specific geophysical techniques designed to aid the interpretation of the fieldwork.

Initial works

- 6.3.36 Initial works in Section B will include setting up the construction compounds including utility diversions and connections in four locations.
- 6.3.37 The Southern Tunnel Entrance compound will affect Heritage Assets 675, 667, 703, 774, 775, 787, 788, 796, 798, 801, 802, 803, 804, 805, 1362, 1372, 1396, 1423, 1459, 1579, 1584, 1595, 1604, 1606, 1607, 1609, 1620, 1622, 1813, 2291, 2308, 3742, 3772, 3773, 3786, 3793, 3796, 3802, 3806, 4415, 4426, 4427, 4428, 4429, 4430, 4608, 4609 and 4610.
- 6.3.38 The A226 Gravesend Road compound will affect Heritage Asset 4595.
- 6.3.39 The Northern Tunnel Entrance compound will affect Heritage Assets 43, 346, 349, 412, 442, 496, 499, 502, 761 and 4613.
- 6.3.40 The Station Road compound will affect Heritage Asset 349.
- 6.3.41 An appropriate mitigation technique has been identified for the sites affected and is set in Table 9.1 and Table 9.2 and described in Chapter 7.
- 6.3.42 The Main Works Construction Access, some of which may begin in the initial works phase will affect 15 Heritage Assets within Section B, many of which will be impacted to a greater degree by the main works construction.
- 6.3.43 These are Heritage Assets 346, 349, 496, 499, 502, 703, 787, 803, 1459, 2291, 2308, 3852, 3854, 4594 and 4609. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and Table 9.2 and described in Chapter 7.

Utility works

- 6.3.44 One temporary ULH will be required in Section B at Shorne Ifield Road. This will affect Heritage Assets 3743, 3745, 3749 and 3756. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

6.3.45 Utilities access will affect Heritage Assets 349, 774, 1852, 2291, 3742, 3743, 3752, 3767, 3772, 3774, 3782, 3805, 3806, 4426, 4428 and 4429. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and Table 9.2 and described in Chapter 7.

South of the River Thames

6.3.46 One National Grid gas transmission pipeline would need to be diverted via the construction of an approximately 2.7km pipeline, extending from the west of Thong Lane to the A226 (Work number G4). Work number G4 extends into construction Section A.

6.3.47 These works (within Section B) will affect Heritage Assets 796, 2291, 3737, 3740, 3741, 3751, 3793, 3805, 3806 and 4425. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

6.3.48 The permanent diversion of 495m horizontally within a length of approximately 1.8km of National Grid Electricity Transmission (NGET) 400kV overhead power line network (Work number OH1). Work number G4 extends into construction Section A.

6.3.49 These works (within Section B) will affect Heritage Assets 774, 1584, 3742, 3767, 3772, 3773, 3774, 3805, 3806, 4425, 4426, 4427 and 4428. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

6.3.50 A new electricity substation would be constructed in the area near the A226 (Work number MU21). This substation would be connected to the existing Northfleet grid substation at the B262 Hall Road via a cable approximately 8.6km in length to be installed as part of the Project. This includes Work numbers MU19 in Section B.

6.3.51 These works (within Section B) will affect Heritage Assets 787, 803, 1459 and 1620. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Section 7.

6.3.52 The reconfiguration of the local network to supply the required electricity north of the A226 from the new substation. This would promote removing 2.8km of existing overhead power lines and poles between Gravelhill Wood and the A226 (Work number OH2). These works extend into Section A.

6.3.53 These works (within Section B) will affect Heritage Assets 1596, 2298, 3752, 3756 and 4610. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

6.3.54 Permanent utility connections would be for the operation of the A122, TSB and the tunnels. Multiple diversions of the network of utilities in Section B are required that would involve the installation of multi-utility corridors for Work numbers MU22 to MU26. Those multi utility corridors that affect Heritage Assets are. Those multi utility corridors that affect Heritage Assets are:

- a. MU20 will affect Heritage Assets 803, 1423, 2308 and 3772
- b. MU24 will affect Heritage Asset 3798

- 6.3.55 An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

North of the River Thames

- 6.3.56 The diversion of overhead power lines (Work numbers OH3, OH4 and MU28) will affect Heritage Asset 349. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Section 7.

Approaches and structures

- 6.3.57 To connect the deep bored tunnel to the surface-level highway, approach ramps would be constructed. The construction of the approaches and structures would take place from approximately mid-2025 to mid-2028.
- 6.3.58 At the North Portal, the deeper part of the approach ramp would be excavated first so that the TBMs can be lowered into the excavation to start tunnelling. Following this, the cut and cover section would be constructed.
- 6.3.59 These works have the potential to affect archaeological remains buried below existing landfill and to remove palaeoenvironmental evidence from deeper deposits within the Thames Gravels. This would include lenses of peat. An appropriate mitigation technique is being developed for the sites affected in consultation with the Local Authority Archaeological Advisors and the Historic England Regional Science Advisor.
- 6.3.60 At the South Portal, the tunnel would emerge into a deep cutting that leads southwards towards the M2/A2/A122 Lower Thames Crossing junction. A deep excavation would be needed to build the section of road between the new M2/A2/A122 Lower Thames Crossing junction and the tunnel.
- 6.3.61 These works will affect Heritage Assets 787, 793, 803, 1372, 1396, 1429, 1459, 1606, 1607, 3786, 3802, 4415 and 4609. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.

Operational access road works

- 6.3.62 The operational access roads providing emergency access at the North Portal would be constructed making use of the haul roads used during the construction phase.
- 6.3.63 This would include construction of an overbridge and on and off slip roads providing emergency access to both the north and south along the new road. These works would involve the construction of an overbridge over the A122 and highways works associated with the creation of roundabouts, access road and associated on- and off-slips.
- 6.3.64 These works would affect Heritage Assets 349, 442, 496 and 643. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Environmental mitigation and compensation, earthworks and landscaping

- 6.3.65 Planting and landscaping would be undertaken as necessary in accordance with the Outline Landscape and Ecology Management Plan (Application

Document 6.7), secured by Requirement 5 of the Draft Development Consent Order (Application Document 3.1) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.

- 6.3.66 South of the River Thames these works will affect Heritage Assets 774, 798, 1362, 1396, 1429, 1584, 3740, 3741, 3743, 3749, 3751, 3756, 4426 and 4428. Additionally, the Nitrogen Deposition Compensation Sites will affect Heritage Assets 1474, 1557 and 4123. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.1 and described in Chapter 7.
- 6.3.67 North of the River Thames these works will affect Heritage Assets 349, 741 and 1833. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Section 7.
- 6.3.68 The material excavated from the approaches and structures and tunnelling work would be temporarily stored within the construction compounds until placed in the permanent locations at Chalk Park, adjacent to the South Portal, and at Tilbury Fields, adjacent to the North Portal.
- 6.3.69 The Chalk Park works take place on the part of the Southern Tunnel Entrance compound and archaeological mitigation will have been carried out prior to the earthworks creation.
- 6.3.70 The Tilbury Fields works take place on the part of the Northern Tunnel Entrance compound and archaeological mitigation will have been carried out prior to the earthworks creation.

Section C construction activities

Preliminary Works

- 6.3.71 There is a potential for ecological mitigation to take place as preliminary works within Section C. All preliminary works will be subject to archaeological mitigation if required. This will be secured through the Preliminary Works REAC and the AMS-OWSI.
- 6.3.72 Archaeological investigation within the preliminary works phase in Section C will include a programme of Palaeolithic and Holocene intrusive fieldwork and specific geophysical techniques designed to aid the interpretation of the fieldwork.

Initial Works

- 6.3.73 Initial works in Section C will include setting up the construction compounds including utility diversions and connections in seven locations. The Station Road compound will affect Heritage Assets 349, 4611 and 4612. The Brentwood Road compound will affect Heritage Assets 7, 1808, 3572, 3574, 3591, 3592, 4173 and 4764. The Stanford Road compound will affect Heritage Asset 3729. The Long Lane compound A will affect Heritage Assets 231 and 247, and Long Lane compound B Heritage Asset 360. Stifford Clays Road compound West will affect Heritage Asset 247 and is contained within the area of the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1). Stifford Clays

Road compound East will affect Heritage Assets 247, 248 and 4615. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

- 6.3.74 The Main Works Construction Access, some of which may begin in the initial works phase will affect 49 Heritage Assets within Section C, many of which will be impacted to a greater degree by the main works construction.
- 6.3.75 These are Heritage Assets 16, 104, 109, 231, 246, 247, 259, 262, 349, 356, 247, 358, 360, 432, 493, 496, 497, 512, 761, 3553, 3554, 3591, 3592, 3594, 3599, 3617, 3627, 3671, 3676, 3724, 3729, 3735, 3904, 3905, 3906, 3907, 3911, 3916, 3917, 3918, 3920, 3921, 3926, 3992, 4206, 4624, 4764, 4767 and 4772. In addition, the access routes cross the area of the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1). An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.76 The creation of a new slip road connecting the A1089 to the A122 northbound would require the land occupied by the Gammonfields Way travellers' site. Prior to the start of construction in this location an alternative site would be established next to its current location, with access off Gammonfields Way. This will affect Heritage Assets 231 and 3624. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Utility Works

- 6.3.77 Eight temporary ULHs would be required in Section C. Low Street ULH will affect Heritage Asset 3674, Muckingford Road ULH will affect Heritage Assets 104 and 3669, Brentwood Road ULH will affect Heritage Asset 4764, Hornsby Lane ULH will affect Heritage Assets 482 and 686, Long Lane ULH will affect Heritage Asset 360, Stifford Clays Road ULH will affect Heritage Asset 247 and is within the area of the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1), Stanford Road ULH will affect Heritage Asset 235 and Green Lane ULH will affect Heritage Asset 223. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.78 Utilities access will affect Heritage Assets 104, 109, 246, 247, 262, 342, 349, 360, 493, 497, 690, 1867, 1877, 3617, 3619, 3620, 3623, 3627, 3670, 3671, 3676, 3911, 3918, 3920, 3922, 4195, 4198 and 4767. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.79 The diversion of the National Grid power line at Tilbury to Linford would require temporary and permanent modifications to an existing 400kV overhead power line, (Work number OH4). This would include the removal of three pylons and construction of five new pylons to cross the A122 and Tilbury Loop railway line. Two temporary diversions of approximately 0.25km and 1.2km length would be required, with the longer length requiring the construction of two temporary pylons to maintain network continuity during the works (Work No OHT2).
- 6.3.80 These will affect Heritage Assets 104, 339, 349, 493, 3670, 3671, 3670, 3675, 3676, 3677, 3918 and 4611. An appropriate mitigation technique has been

identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

- 6.3.81 Construction works in Section C would affect two 132kV overhead line networks east of Tilbury (Work number OH3 and OH5). One, running from south of the Tilbury Loop railway line to north-west Linford, would require the undergrounding of approximately 2.2km of existing overhead powerline network (Work number OH3) via the installation of approximately 2.37km of underground cable (Work number MU28). The works include removal of eight existing pylons and modification of an existing pylon. A further existing pylon would be demolished, to be replaced by the construction of a new terminal pylon in the same location north of Muckingford Road. This would be completed by the construction of a temporary pylon and 0.6km of temporary overhead powerline (Work number OHT3) to maintain electricity supply while the new pylon is constructed.
- 6.3.82 These will affect Heritage Assets 104, 410, 493, 690, 3903, 3907, 3914, 3918, 4194, 4198 and 4625. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.83 Temporary and permanent modifications would be required to two existing National Grid overhead power line networks from Chadwell St Mary to Stifford Clays Road. The first network to be diverted is a 400kV overhead line requiring a permanent diversion of 1.2km horizontally within a length of approximately 1.7km of the network (Work number OH6). It is located west of Hornsby Lane heading west of the A1089 and then north to the A13. These works would include building four new pylons and removing four existing ones. Two short-term diversions of approximately 0.6km and 0.4km (Work numbers OHT5 and OHT6 respectively) of the powerline on to two temporary pylons would be needed to maintain electricity supply while new pylons are installed.
- 6.3.84 The second network to be diverted, includes the permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction, located west of Hornsby Lane heading west of the A1089, then north over the A13 to Stifford Clays Road within Section C.
- 6.3.85 These will affect Heritage Assets 5, 109, 246, 247, 262, 342, 1867, 3553, 3559, 3592, 3598, 3615, 3617, 3619, 3623, 3627 and 3729. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.86 Works would be required in three separate locations for Cadent's high-pressure gas network and associated infrastructure:
- a. An approximately 0.27km diversion of a high-pressure pipeline would be required east of Brentwood Road at the western edge of Orsett Golf Club (Work number G5). This will affect Heritage Assets 243, 259 and 4207. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

- b. An approximately 5.23km diversion of a high-pressure pipeline would be required from Green Lane to Stanford Road. (Work number G6). Additional short pipelines and a new gas valve compound are required at the Stanford Road end. The design of this pipeline was amended to avoid the schedule monument Springfield style enclosure and Iron Age enclosures south of Hill House, Baker Street (Heritage Asset SM7). These works will affect Heritage Assets 258, 355, 358, 2108, 3615, 3724, 3732, 3735, 3765, 3820, 4765 and 4766. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- c. An approximately 0.34km diversion of a high-pressure pipeline would be required to cross the Project route north of Green Lane (Work number G7). This does not affect any Heritage Assets.

6.3.87 Multiple diversions of the network of utilities in Section C are required that would involve the installation of multi-utility corridors for Work numbers MU29 to MU60. Those multi utility corridors that affect Heritage Assets are:

- a. MU30 will affect Heritage Asset 4611
- b. MU31 will affect Heritage Assets 104 and 4196
- c. MU32 will affect Heritage Assets 410, 4194, 4196 and 4198
- d. MU33 will affect Heritage Asset 104
- e. MU34 will affect Heritage Assets 104, 318, 3677, 3703, 4624 and 4625
- f. MU36 will affect Heritage Assets 318, 493, 3668, 3672, 3908, 3918, 3920 and 3925
- g. MU37 will affect Heritage Assets 432 and 3923
- h. MU38 will affect Heritage Assets 344, 459, 3599, 3619, 3922 and 4769.
MU39 will affect Heritage Asset 4767
- i. MU40 will affect Heritage Assets 3559, 3572, 3591, 3592, 3598, 3729 and 4764
- j. MU41 will affect Heritage Assets 245 and 3729
- k. MU43 will affect Heritage Assets 207 and 257
- l. MU44 will affect Heritage Assets 257 and 262
- m. MU47 will affect Heritage Assets 3588, 3589 and 3729. MU48 will affect Heritage Asset 3627
- n. MU49 will affect Heritage Asset 262

- o. MU50 will affect Heritage Asset 262
- p. MU51 will affect Heritage Asset 219
- q. MU54 will affect Heritage Asset 357
- r. MU55 will affect Heritage Asset 362
- s. MU56 will affect Heritage Assets 246, 247 and 360, and the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1)
- t. MU 57 will affect Heritage Assets 247 and the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1)
- u. MU 58 will affect Heritage Assets 247 and the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1)
- v. MU60 will affect Heritage Assets 247 and the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1)

6.3.88 An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Tilbury Viaduct

6.3.89 Tilbury Viaduct would be constructed to carry the new road over the Tilbury Loop railway line.

6.3.90 These works would affect Heritage Assets 104, 410, 3670, 3671, 3675, 3676, 4194, 4195, 4196, 4197 and 4614. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Chadwell St Mary Link

6.3.91 Works to the south of the A13/A1089/A122 Lower Thames Crossing junction comprise the main route from Tilbury Viaduct to south of the A13, this would include major earthworks, preparation of the new road surface, drainage and finishing works from the A13 to the Tilbury Viaduct. Additionally, the Muckingford Road green bridge, the Brentwood Road bridge and the Hoford Road green bridge will be constructed.

6.3.92 These works would affect Heritage Assets 104, 259, 318, 325, 342, 432, 446, 450, 493, 715, 3553, 3554, 3567, 3570, 3591, 3592, 3594, 3598, 3599, 3619, 3627, 3668, 3672, 3677, 3729, 3903, 3904, 3905, 3906, 3907, 3908, 3911, 3916, 3917, 3918, 3920, 3921, 3922, 3923, 3925, 3926, 4173, 4174, 4206, 4625, 4764, 4767, 4769, 4771, 4772, 4773 and 4774. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

A13/A1089/A122 Lower Thames Crossing junction

6.3.93 The proposed junction between the A122, the A13 and A1089 would require changes to the existing A13 junction as well as modifications to approach roads.

- 6.3.94 These include the construction of the A13 underpass east of the A1089 the replacement of the bridge carrying Rectory Road over the A13, the realignment of the A1013 (Stanford Road), which would include building three new bridges. This would involve construction activity including piling and earthworks.
- 6.3.95 The Orsett Heath Viaduct would be built over Baker Street and the A1089. The road south of the A13 would be realigned to its connection with the A1013. Heath Road would be realigned from the A1013 to 250m south of the A1013. This would require some earthworks and standard road construction.
- 6.3.96 The existing Gammonfields Way travellers' site would be relocated to allow a new slip road to connect the A1089 northbound to the A122 northbound. This would involve earthworks and road construction.
- 6.3.97 Stifford Clays Road would need to be realigned and two bridges would be built to allow construction of the A122 underpass. Green Lane would be realigned, and a green bridge built with features that allow wildlife to pass over it.
- 6.3.98 A series of roads and bridges would need to be constructed to link the A122 to the A13 and the Orsett Cock junction. Most of these works would take place away from the existing road network.
- 6.3.99 These works would affect the scheduled monument Orsett Cropmark Complex (Heritage Asset SM1) and three Grade II Listed Buildings, Murrells Cottages (Heritage Asset LB96), Thatched Cottage (Heritage Asset LB58) and 1 and 2 Grays Corner Cottages (Heritage Asset LB89). Additionally, the junction will have an effect on the setting of the Grade II Listed Building Baker Street Windmill (Heritage Asset LB57).
- 6.3.100 These works will affect Heritage Assets 197, 219, 231, 246, 247, 258, 262, 356, 357, 358, 360, 513, 1823, 1824, 3565, 3615, 3617, 3624, 3723, 3724, 3726, 3733, 3734, 3735 and 4615.
- 6.3.101 An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Environmental mitigation and compensation

- 6.3.102 Planting and landscaping would be undertaken as necessary in accordance with the Outline Landscape and Ecology Management Plan (Application Document 6.7), secured by Requirement 5 of the Draft Development Consent Order (Application Document 3.1) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.
- 6.3.103 These works will affect Heritage Assets 243, 259, 432, 520, 3553, 3574, 3599, 3601, 3671, 3675, 3676, 3905, 3907, 3917, 3922, 3924, 3957, 3959, 4206, 4767 and 4770. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Section D construction activities

Preliminary Works

- 6.3.104 There is a potential for ecological mitigation to take place as preliminary works within Section D. All preliminary works will be subject to archaeological

mitigation if required. This will be secured through the Preliminary Works REAC and the AMS-OWSI.

- 6.3.105 Preliminary works will also include a small number of archaeological trial trenches on the site of the M25 compound, part of which was not investigated as the design changed after the programme of archaeological trial trenching had been completed. Other archaeological investigation within the preliminary works phase in Section D will include a programme of Palaeolithic and Holocene intrusive fieldwork and specific geophysical techniques designed to aid the interpretation of the fieldwork.

Initial Works

- 6.3.106 Initial works in Section D will include setting up the construction compounds including utility diversions and connections in five locations. The Mardyke compound will affect Heritage Asset 3883. The Medebridge compound will affect Heritage Asset 3847. The M25 compound works will affect Heritage Assets 186, 594, 595, 598, 605, 611, 1810, 3680, 3682, 3683, 3688, 3848, 3876 and 4761. The Ockendon Road compound will affect Heritage Assets 3721, 3722 and 3836. The Warley Street compound will affect Heritage Asset 3696. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.107 The Main Works Construction Access, some of which may begin in the initial works phase will affect 25 Heritage Assets within Section D, many of which will be impacted to a greater degree by the main works construction. These are Heritage Assets 29, 30, 109, 117, 184, 267, 361, 380, 605, 3685, 3687, 3691, 3833, 3835, 3865, 3879, 3883, 3897, 3898, 3899, 3902, 3949, 3952, 4626, 4762 and 4763. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Utility Works

- 6.3.108 Three temporary Utility Logistic Hubs (ULHs) and associated access routes are being created in Section D. The Folkes Lane ULH will affect Heritage Asset 4204. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.109 The Medebridge ULH and the Beredens ULH will not affect any known heritage assets, but as little or no archaeological trial trenching took place on the ULH archaeological monitoring and recording is proposed during the construction of the ULH.
- 6.3.110 Utilities access will affect Heritage Assets 109, 167, 169, 184, 361, 3722, 3846, 3883, 3891, 3897, 3902 and 4204. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.111 The Diversion of National Grid power lines at the Mardyke includes the permanent diversion of 2.47km horizontally within a length of approximately 3.2km of NGET 275kV overhead powerline network at the A13/A1089/A122 junction within Section C. A further area of works of approximately 0.7km at the Mardyke, within Section D, requires the construction of a replacement pylon 16m taller than the existing one, on the alignment of the current overhead powerlines (Work number OH7).

- 6.3.112 These works will affect Heritage Assets 109, 682 and 3902. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.113 UK Power Networks will divert approximately 1km of 132kV overhead powerline within the Thames Chase Forest Centre area (Work number OH8). The works would include the construction of two new pylons and the removal of two existing pylons.
- 6.3.114 These works will affect Heritage Assets 3722, 3886, 3891 and 3895. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.115 Approximately 0.63km of Cadent Gas high-pressure pipeline would be diverted to cross the M25 north-east of Folkes Lane (Work number G10).
- 6.3.116 These works will not affect any known heritage assets, but as no archaeological trial trench took place in the area archaeological monitoring and recording is proposed during the stripping of the easement for the diversion.
- 6.3.117 Two sections of the high-pressure pipeline that was the feed for the now demolished Barking Power Station are to be removed as part of the proposals (Work numbers G8 and G9).
- 6.3.118 The removal of G8 will affect Heritage Assets 380 and 3835 and the removal of G9 will affect Heritage Assets 117, 184, 361 and 4763. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.119 Approximately 2.7km of 900mm water trunk main would be diverted via a 3.12km installation of new pipeline (Work number MU72).
- 6.3.120 These works will affect Heritage Assets 171, 624, 3713, 3722, 3836, 3837, 3846 and 3892. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.
- 6.3.121 Multiple diversions of the network of utilities in Section D are required that would involve the installation of multi-utility corridors for Work numbers MU61 to MU92. Those multi utility corridors that affect Heritage Assets are:
- a. MU62 will affect Heritage Asset 3949
 - b. MU64 will affect Heritage Asset 3835
 - c. MU67 will affect Heritage Assets 361 and 3691
 - d. MU69 will affect Heritage Asset 361 and 3687
 - e. MU70 will affect Heritage Asset 361
 - f. MU71 will affect Heritage Assets 3705 and 4762
 - g. MU73 will affect Heritage Assets 173 and 3846
 - h. MU75 will affect Heritage Asset 3846
 - i. MU76 will affect Heritage Asset 173

- j. MU77 will affect Heritage Asset 3836
- k. MU78 will affect Heritage Asset 173
- l. MU79 will affect Heritage Assets 171 and 3892
- m. MU82 will affect Heritage Assets 171 and 3892
- n. MU84 will affect Heritage Asset 2024
- o. MU85 will affect Heritage Asset 3696
- p. MU86 will affect Heritage Assets 169 and 170
- q. MU87 will affect Heritage Asset 169
- r. MU92 will affect Heritage Asset 167

6.3.122 An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Ockendon Link

6.3.123 The Ockendon link is the 5km section of the A122 that extends between the A13 and M25. It includes construction of two viaducts, three embankments, earthworks cuttings, two footbridges and an overbridge to carry North Road (B186) over the A122.

6.3.124 These works will affect Heritage Assets 29, 30, 117, 184, 267, 361, 380, 3680, 3682, 3683, 3685, 3687, 3688, 3689, 3691, 3832, 3833, 3835, 3840, 3848, 3857, 3865, 3866, 3870, 3878, 3879, 3883, 3897, 3898, 3899, 3902, 3949, 3952, 4626, 4762 and 4763. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

LTC/M25 Junction

6.3.125 This section of the Project includes the construction of new roads to form a junction between the new A122 and the M25. Works would include a cutting to take the A122 northbound below the existing ground level before passing under the existing M25 via a new underpass and joining the M25 northbound approximately 1km north of Ockendon Road. Access to the A122 southbound would be at grade via a new on-slip from the existing M25, north of Ockendon Road, passing under the Ockendon Road bridge.

6.3.126 These works will affect Heritage Assets 56, 174, 594, 611, 3712, 3713, 3721, 3722, 3836, 3837, 3846, 3876 and 4627. Additionally, the deep excavations for the underpass have the potential to affect Palaeolithic deposits and palaeoenvironmental deposits from the Palaeolithic and Holocene. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

M25 Widening including M25 J29

- 6.3.127 These works would take place south of M25 junction 29 to where the A122 connects to the M25 and would involve widening the M25 St Marys Lane bridge and the Shoeburyness railway line bridge.
- 6.3.128 These works will affect Heritage Assets 167, 168, 169, 170, 582, 585, 586 and 2024. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

Environmental mitigation and compensation

- 6.3.129 Planting and landscaping would be undertaken as necessary in accordance with the Outline Landscape and Ecology Management Plan (Application Document 6.7), secured by Requirement 5 of the Draft Development Consent Order (Application Document 3.1) and as identified on Figure 2.4: Environmental Masterplan (Application Document 6.2). Planting and landscaping would be undertaken once construction activities are completed and the land would no longer be affected by ongoing works.
- 6.3.130 Where environmental mitigation and compensation is happening outside of the main construction area the works will affect Heritage assets 170,172, 3721, 3722, 3833, 3899, 3936, 3952 and 4626. An appropriate mitigation technique has been identified for the sites affected and is set out in Table 9.2 and described in Chapter 7.

6.4 Archaeological mitigation measures

- 6.4.1 A range of archaeological mitigation measures are proposed, considering the form and significance of the archaeological remains or other heritage assets that would be impacted by the Project. The principal techniques are listed below.
- Preservation *in situ*: for example, the protection of heritage assets through fencing or protective matting
 - Recording of upstanding heritage assets: for example, a written, drawn, or photographic description and interpretation of a building or a monument that is above the ground
 - Non-intrusive archaeological fieldwork: for example, geophysical survey, controlled metal detecting or fieldwalking
 - Intrusive archaeological fieldwork: for example, detailed archaeological excavation or strip map and sample excavation
 - Archaeological monitoring and recording during construction: for example, attendance on site, during construction activity, by an archaeologist who can stop works to record any archaeological features and retrieve any archaeological material uncovered during construction. NB this will be used in a very small number of cases

- f. Outreach and engagement: for example, a programme of activities, lectures, regular briefings, and engagement activities as set out in the “Public Archaeology and Community Engagement Plan
- g. Post excavation: for example, the interpretation of the site archive created during the mitigation phases, the analysis and conservation of materials recovered during the archaeological work, the production of text figures and plates, preparing reports
- h. Publication: for example, preparing notes for relevant journals, popular reports, and full excavation reports with specialist reports to advance understanding of those heritage assets lost (wholly or in part) because of the Project
- i. Palaeolithic and geoarchaeological mitigation: for example, a programme of boreholes and sampling to recover sediments for further archaeological analysis and scientific dating, or excavations into Palaeolithic deposits, some of which may be deeply buried

6.4.2 A total of 383 Heritage Assets comprising, 369 archaeological remains, eleven historic buildings and three historic landscape types have been identified that require either preservation and protection or recording. These are set out in Table 9.1, Table 9.2 and Table 9.3.

Preservation *in situ*

6.4.3 Heritage Assets and archaeological sites that will be protected by a combination of protection measures that will be put in place at the start of the construction programme to ensure their long-term survival are identified in Table 9.1 and Table 9.2.

6.4.4 Relevant protection measures would include temporary protective fencing which will be maintained throughout the preliminary works and construction stages (incorporating an additional 10m buffer area for specific identified designated and non-designated assets where possible), and at some locations would include using a combination of an appropriate protective barrier membrane, suitable fill material to bury archaeological remains and vehicle/plant control measures. Some sites will also require archaeological photographic recording prior to protection measures to ensure that there is a record of their existing condition, prior to the start of any groundworks.

6.4.5 For each site or heritage asset, protection measures will be described in a site-specific method statement prepared in consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors) and, where appropriate, Historic England. Which will also include arrangements for regular site inspections by the ACoW, maintenance requirements, and Tool Box Talks to inform all site personnel of the archaeological and historic environment constraints on site, the protection measures that are required and their obligations under the draft AMS-OWSI and generally, to ensure that these are put in place and complied with. New sites may be added to the number of sites for preservation of archaeological remains, or existing sites may be adjusted.

- 6.4.6 Archaeological photographic recording of sites will be undertaken by the Archaeological Contractor before protection measures are deployed and after their removal.

Recording of heritage assets

Topographic survey

- 6.4.7 Topographic survey is an archaeological site survey carried out to record the shape and topography of the ground surface and any relevant components. It would include both a drawn and written record and depending upon the level of detail that is required, could also include a photographic record. The level of detail would be specified in the relevant SSWSI, which will be submitted to and approved by the Secretary of State following consultation with the relevant Local Planning Authority as secured by Requirement 9 of the Draft Development Consent Order (Application Document 6.3).
- 6.4.8 Topographic survey will be used to record earthwork features that are visible within the Project footprint and which would be destroyed as a result of construction activity. Various survey techniques will be deployed on a site-by-site basis to record these earthworks which would be described in each SSWSI and may be combined with other mitigation measures such as photographic recording.

Archaeological photographic recording

- 6.4.9 This is a photographic record combined with a written description of a heritage asset that records its current condition, character and type. Depending upon the level of detail required, the photographs may also record views to and from the asset so that there is a record of its setting. The level of detail would be specified in the relevant SSWSI, which will be submitted to and approved by the Secretary of State following consultation with the relevant Local Planning Authority as per Requirement 9 of the Draft Development Consent Order (Application Document 3.1).
- 6.4.10 Archaeological photographic recording will be used to record the current condition of heritage assets that have been selected for preservation *in situ*, prior to the installation of any protective fencing, and for built heritage assets due to be demolished as part of the Project. The level of photographic recording would be described in each SSWSI.

Historic building recording

- 6.4.11 Historic building recording will be used to mitigate the loss of those historic buildings that would be demolished as a result of the Project, through preserving a record of the building. This will comprise a drawn and photographic record of the interior and exterior of the building before, and possibly during, dismantling. For each historic building, the precise scope and methods appropriate to that building would be described in the SSWSI.
- 6.4.12 Historic England identifies four levels of historic buildings recording. Level 1 is a basic visual record, Level 2 includes a descriptive record, Level 3 adds an analytical component and Level 4 provides a comprehensive analytical record (Historic England, 2016).

- 6.4.13 In some situations, for example where a building is not lost but the setting is altered, the recording will extend to the setting of the building and will record their relationship and the extent of the existing setting.
- 6.4.14 Where a historic building or structure has been identified as having the potential to be impacted by vibration as a result of the Project, a condition survey will be carried out before that element of the Project begins. The relevant ACoW will ensure regular monitoring of the historic building or structure and notify the National Highways Historic Environment Manager of any changes.

Historic Landscape Recording

- 6.4.15 Where the character of historic landscape types is significantly changed a selection of historic components and views should be photographically recorded. In some areas further historical research may be required to record the significance of a historic landscape type before it is lost. Historical and documentary research will be particularly useful in those areas with a greater time depth but where no visible landscape features from that previous land use remain, but that land use did influence the current landscape. For example, those parts of Gravesham that were originally parts of large estates that no longer exist.

Non-intrusive archaeological fieldwork

Fieldwalking

- 6.4.16 In some locations along the Project, surface artefact collection will be carried out in order to investigate surface artefact distributions. Fieldwalking is proposed in these areas, to be completed prior to the commencement of other forms of intrusive archaeological mitigation. The full extent of the DCO boundary in these areas will be included in the fieldwalking programme, including areas where there will be ground disturbance and areas of landscaping.
- 6.4.17 The timing of the fieldwalking programme will take account of the prevalent agricultural regime and opportunities will be sought to undertake this non-intrusive survey work prior to the making of the DCO, through voluntary land access agreements. Where existing land uses, such as grassland, preclude fieldwalking prior to compulsory acquisition, arrangements will be made for the ground to be prepared for fieldwalking (ploughing, then harrowing) at the earliest opportunity once access is taken. Opportunities for such preparation as part of voluntary access agreements will also be pursued to ensure timely completion of the survey.
- 6.4.18 It is recognised that surface artefact collection remains contingent on timing, and results can be affected by variables of ground, weather and light conditions.

Controlled metal detecting

- 6.4.19 This would involve metal detecting, under the control of a suitable archaeologist, carried out in a systematic manner to allow the accurate recording, plotting and retrieval of buried archaeological metalwork.

Geophysical survey

- 6.4.20 In some locations, where this has not previously been possible, geophysical survey will be undertaken. This may be undertaken alongside other mitigation or

in advance of intrusive excavation, in order to understand likely presence, extent and nature of buried archaeological remains. Geophysical survey may also be combined with geoarchaeological and palaeoenvironmental investigations and the Palaeolithic and Holocene intrusive fieldwork.

Intrusive archaeological fieldwork

Topsoil artefact sampling

- 6.4.21 In some parts of the Project a gridded test pitting programme will be required, which aims to map artefact distributions and support identification of potential activity areas, where artefacts in the topsoil may be the only visible evidence for archaeological activity at that location.

Detailed excavation

- 6.4.22 Sites or areas designated for detailed excavation will be stripped with mechanical plant as set out in the SSWSI, unless certain specific areas require further targeted test-pit mitigation to recover artefacts from the topsoil. If the latter is the case, the methods to be used will be specified in the appropriate SSWSI. For areas where machine stripping is required, this means the stripping of topsoil, subsoil or other overburden to the correct archaeological level under the supervision of a qualified archaeologist, using back-acting mechanical plant fitted with a toothless bucket, in such a manner as to cleanly expose the archaeological horizon. Dump trucks and other plant will not be permitted to track over stripped areas until archaeological investigations are complete and the archaeological site or area is signed-off.
- 6.4.23 Sites or areas opened for detailed excavation and/or archaeological monitoring and recording will be subject to archaeological survey, resulting in a digital pre-excavation plan. In accordance with the research objectives as identified in the approved SSWSI, the archaeological site or area would then be subject to the sample excavation of key features designed to recover artefactual dating evidence, and selected feature complexes would be subject to further excavation designed to resolve stratigraphic relationships.
- 6.4.24 The works would also include sampling of archaeological features for charred plant remains, molluscs, pollen, and other palaeoenvironmental and palaeoeconomic indicators, where suitable preservation conditions exist in combination with archaeological deposits. Artefact and environmental assessments would be carried out during the works and selected key features may be subject to more detailed excavation and sample recovery, to address the research objectives of the archaeological programme.
- 6.4.25 The proportion of features excavated would be determined by the importance of the features and the requirements of the research objectives. The iterative process outlined allows the approach to excavation sampling to be closely targeted to address specific questions, rather than being tied to a pre-determined excavation strategy.
- 6.4.26 The research objectives and excavation strategy will be kept under review. It is critical for the success of this approach that most data, artefact, and environmental sample processing are carried out whilst the investigation proceeds (including artefact spot-dating and preliminary assessment of

environmental samples). Decisions on further investigation in each area would be made as soon as sufficient information becomes available.

- 6.4.27 A Project-wide programme of radiocarbon dating will be carried out on samples from suitably secure contexts to place the main historical processes that have affected landscape development within an absolute chronological framework.
- 6.4.28 Palaeoenvironmental samples will be recovered where suitable deposits are present, particularly from waterlogged sequences or deposits sealed in a primary context, to assist with regional palaeoenvironmental reconstruction.
- 6.4.29 Geoarchaeological investigations will focus on areas of interest as identified through previous and current archaeological evaluations and be specifically designed to address research questions.

Strip, map, and sample excavation

- 6.4.30 Strip, map, and sample comprises the archaeologically controlled strip of a defined area within the Order Limits under the direction of a suitably qualified archaeologist; the mapping of archaeological remains revealed; and the excavation of a sample of the archaeological remains and the subsequent post-excavation assessment, analysis, and publication.
- 6.4.31 The objective is to allow a clear view over a wider area of previously undisturbed horizons which may reveal archaeological features, sites, artefacts, or structures.
- 6.4.32 All stripping of overburden within the defined area would be carried out by 360° excavators equipped with a toothless ditching bucket, and under constant archaeological supervision.
- 6.4.33 The site will be fenced and fitted with adequate signs, describing that there is an archaeological site, and that access is restricted until the archaeological mitigation work is completed. Construction staff will be made aware of the presence of archaeological sites and the need to preserve them, through the site induction as well as regular toolbox talks.
- 6.4.34 The site will be excavated and recorded according to accepted professional standards described in the relevant SSWSI, by the archaeological contractor.

Trial trench evaluation

- 6.4.35 At the Preliminary Works stage additional trial trenching will be carried out in areas along the Project where, although all evaluation necessary for the purposes of the ES was completed, detailed evaluation was not completed due to access issues, or where a more limited amount of survey work was undertaken. The purpose of the trenching will be to determine the presence/absence, extent, character, condition and significance of the remains in order to inform the detailed mitigation requirements at these locations should it be required.

Geoarchaeological and palaeoenvironmental investigation

- 6.4.36 Geoarchaeological and palaeoenvironmental investigation involves a programme of sample recovery and assessment/analysis carried out to investigate palaeoenvironmental conditions and soil sediment development that may be relevant to the research of archaeological sites or remains found within

the vicinity. This is achieved through trial pit excavations or other soil sample retrieval methods (such as auger or boreholes).

- 6.4.37 The information from the geoarchaeological and palaeoenvironmental work will be used to update the Palaeolithic and Quaternary Deposit Model (Lower Thames Crossing: Palaeolithic and Quaternary Deposit Model (PQDM) and Desk-based Assessment of Palaeolithic Potential, ES Appendix 6.5, Application document Appendix 6.5) and inform further fieldwork. The geoarchaeological techniques will include sediment description and interpretation to inform a programme of scientific dating (e.g. C14, OSL) and palaeoenvironmental sampling for macrofossils (e.g. molluscs, plants) and microfossils (e.g. pollen, phytoliths, diatoms, foraminifera, ostracods) where appropriate.
- 6.4.38 Where peat deposits are identified within 5m of the surface, a programme of trenching and test pitting will be carried out to recover archaeological and palaeoenvironmental remains. Suitable sections will be subject to geoarchaeological and palaeoenvironmental sampling which may be augmented by coring and boreholes. Inaccessible peat deposits at a greater depth than 5m will be mitigated using coring and boreholes to sample the deposits for geoarchaeological and palaeoenvironmental investigation (see above).
- 6.4.39 Where archaeological remains, especially waterlogged remains such as wood and leather are identified within peat deposits, specific techniques for their excavation, sampling and preservation will be used alongside the standard archaeological fieldwork techniques to prevent degradation. These include the use of non-metal tools for excavation of delicate remains, dendrochronological sampling, specific on-site cold/wet storage, and transportation.

Palaeolithic and holocene intrusive fieldwork

- 6.4.40 A deposit-led staged approach to Palaeolithic fieldwork will be carried out. The information from the fieldwork will be used to update the Palaeolithic and Quaternary Deposit Model (PQDM) and further proposed fieldwork. Where deposits with Palaeolithic potential occur within 5m of the surface, a programme of trenching and test pitting will be carried out, both informed by and augmented by coring and boreholes.
- 6.4.41 Four areas have been identified where there is a high potential for survival of Palaeolithic land surfaces and other significant deposits surviving below 5m:
- a. The area to the north of the South Portal
 - b. Between the North Portal and Low Lane
 - c. To the west of North Road
 - d. The North Ockendon Channel around the M25
- 6.4.42 Where there is a high potential for survival of Palaeolithic land surfaces and other significant deposits below 5m, a two stage approach to mitigation will be adopted.
- 6.4.43 The first stage will include the excavation of test pits a minimum of 10m x 10m to the depth to which the Project has potential to impact the deposits. This will be a substantial excavation requiring protection of the walls of the trench to

allow a safe working area at depth. All archaeological and palaeoenvironmental deposits will need to be excavated and recorded and a detailed sampling strategy for scientific analysis and dating developed and revised during the excavation. Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.

- 6.4.44 The second stage is an iterative development of the first stage with further works determined by the outcomes of the first stage. The second stage could include further excavation at depth, additional sampling and analysis of deposits, or a process for the sampling of bulk material and retrieval of any archaeological or palaeoenvironmental material. Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.
- 6.4.45 Inaccessible deposits of Palaeolithic potential will be investigated using coring and boreholes.
- 6.4.46 In the event that *in situ* Palaeolithic remains (e.g. flint scatters, butchery sites) are identified and preservation *in situ* is not possible, open area excavation may be warranted. This would include specific Palaeolithic site recording and excavation techniques such as 3/4D recording, grid square excavation and sediment sieving at an appropriate resolution.

Publication and dissemination

- 6.4.47 The culmination of the mitigation programme will be the publication and dissemination of the results of the investigations. This will include popular and academic publication and the dissemination of information to a wide technical and lay audience via a variety of forums. Professional and technical papers will be published assessing the outcomes of archaeological processes, methods, logistical organisation and techniques applied in the course of Project assessment and mitigation works.
- 6.4.48 At the end of the fieldwork the post-excavation assessment would determine the scope and content of the academic publication which will take the form of a monograph(s) and articles in relevant local, period and technical heritage journals. Fieldwork roundups will be published annually in local and period journals. Data will be fed periodically into the three relevant Historic Environment Records. Popular booklets will be produced for a general readership as part of the Public Archaeology and Community Engagement strategy (Annex A). Open access publication will be considered for both academic and popular products (Chapter 8)
- 6.4.49 The dissemination strategy will include the transfer of the complete project archive (site archive and research archive) to an appropriate repository, or repositories, for long-term storage and curation. This will preserve the archive for use in future research projects and allow continued presentation of material to the public by various Museums. The digital archive will be deposited in an appropriate digital archive.
- 6.4.50 The approach to publication and dissemination is set out in more detail in Chapter 8.

Public archaeology and engagement strategy

- 6.4.51 The LTC Public Archaeology and Community Engagement Strategy (PACE strategy) will aim to collaboratively interpret and communicate the results of the archaeological evaluation and mitigation programmes to a wide audience, including local communities directly impacted by the Project.
- 6.4.52 The Strategy will aim to deliver a legacy from the archaeological investigation and recording works undertaken for the Project. The objective will be to provide information to a wide variety of audiences, ranging from those with a strong interest in archaeology and heritage to those with no specific involvement.
- 6.4.53 The Public Archaeology and Community Engagement Strategy is outlined in Annex A.

7 Outline Scheme of Written Investigation

7.1 Approaches to archaeological mitigation

General

- 7.1.1 The final Strategy will be implemented in accordance with advice in DMRB LA116 (2019)
- 7.1.2 Sites that require investigation will include those identified in Table 9.1, Table 9.2 and Table 9.3. New areas for investigation may be identified because of emerging results and unexpected discoveries.

Site Specific Written Schemes of Investigation (SSWSI) and method statements

- 7.1.3 Site Specific Written Schemes of Investigation (SSWSIs) will be prepared setting out in detail specific mitigation measures for the detailed design of the Project, informed by the strategy described in the AMS-OWSI. Existing models and new datasets collected during fieldwork will inform design of mitigation works in the SSWSIs during the investigations. These SSWSIs will be prepared by the relevant Archaeological Contractor in consultation with the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors and Historic England. The SSWSIs will be approved by the SoS following consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors) and Historic England, prior to works commencing in the area to which each SSWSI applies.
- 7.1.4 The specification for the archaeological works contained within the SSWSIs will be written in accordance with the AMS-OWSI, the current version of DMRB LA116 (2019), and the current Standard and Guidance for archaeological excavation prepared by the ClfA (ClfA, 2014a) and the current ClfA Code of Conduct (ClfA, 2014f), and will adhere to all current and relevant best practice and standards and guidelines.
- 7.1.5 Each SSWSI will set out the timing and order of the investigative works and will include details of how the archaeological programme will interact with other construction activities, and the parties undertaking them. Each SSWSI will include a programme for the archaeological work that will be referenced against key milestones/events in the overall design and construction programme.
- 7.1.6 The ACoW and/or the Archaeological Contractor(s) will give Tool Box Talks (see Glossary) to inform all site personnel of the archaeological and historic environment constraints on site, the protection measures that are required and their obligations under the AMS-OWSI, SSWSI and generally, to ensure that these are put in place and complied with.
- 7.1.7 The relevant Principal Contractor(s) will prepare a Method Statement (MS) as part of the SSWSIs, for activities requiring archaeological mitigation, prior to the commencement of the relevant archaeological intervention. In areas where archaeological remains or other heritage assets are to be retained (e.g. protected by temporary perimeter fencing, or beneath fill materials, or control measures for plant movements at construction), the MS will be

prepared at the start of the construction stage in order to describe specific protection measures to be applied to the site or area of interest, and following procedures outlined in the AMS-OWSI and the SSWSI.

- 7.1.8 MSs will be prepared by the relevant Archaeological Contractor in consultation with National Highways Historic Environment Manager, the relevant local authority archaeological advisors and Historic England. They will be approved by the relevant Local Authority Archaeological Advisors. Any material amendments required to the SSWSIs, including MSs will be made in consultation with National Highways, the relevant Local Authority Archaeological Advisors and Historic England.

Archaeological project team

- 7.1.9 The archaeological mitigation works within each Contract will be delivered by an Archaeological Project Team (APT) under the leadership of an experienced Project Manager. The APT will be provided by one or more Archaeological Contractors, to be appointed by the relevant Principal Contractors. The Archaeological Contractor(s) will have prime responsibility for delivery of the full programme of archaeological mitigation as set out in the AMS-OWSI, including, all on and off-site works; technical and non-technical publication and dissemination; and preparation and deposition of the archaeological project archive with the recipient museum or other appropriate storage facility.
- 7.1.10 The APT will include named key specialists who will either be site-based or have a regular site presence, or who will be on-call at short notice. These will include (but not be limited to) the following roles:
- a. Project Manager
 - b. Environmental archaeology co-ordinator
 - c. Environmental archaeology supervisor
 - d. Archaeobotanist
 - e. Charcoal specialist
 - f. Archaeomalocologist (molluscs)
 - g. Materials scientist
 - h. Finds co-ordinator/processing specialist
 - i. Lithics specialist with relevant period expertise
 - j. Ceramics specialist with relevant period expertise
 - k. Geo-archaeologist
 - l. Geophysicist
 - m. Archaeological surveyor
 - n. Digital data co-ordinator/manager
 - o. Human remains specialist
 - p. Animal bone specialist

- q. Scientific dating specialist
- r. Conservation specialist
- s. Statistician
- t. Metal-detectorist
- u. Public Archaeology and Community Engagement Team

- 7.1.11 The names and qualifications of the individuals fulfilling these roles will be provided to National Highways for information and comment, immediately after appointment of the Archaeological Contractor(s). The postholders shall be in place at the start of the mitigation programme. Any changes to the named APT postholders will be notified to National Highways, for information and comment.
- 7.1.12 The specialists appointed to the APT will be fully integrated into the archaeological contractor's project team to actively input to the design of strategies for the SSWSIs, the public archaeology and community engagement elements, and to advise throughout the fieldwork and post-excavation stages. Regular communication between specialist members of the APT and the fieldwork Project Manager and field staff will be ensured through off-site planning meetings, site visits and progress meetings.
- 7.1.13 Archaeological staff (part of the Archaeological Contractor's site team) supervising the investigative works as described in the AMS-OWSI and relevant SSWSI shall be experienced in directing machine stripping/hand stripping of archaeological sites in Chalk, Head, Thames Terraces and alluvium, colluvial and gravel deposits, with direct experience in and knowledge of the archaeological character of the area in general. The staff member(s) shall be familiar with the content of the results of the relevant previous geophysical surveys, artefact collection, ATT, AMS-OWSI and relevant SSWSI.

Unexpected finds

- 7.1.14 If unexpected finds (sites, artefacts, environmental remains or ecofacts, monuments or features) are made during the construction stage a site consultation meeting(s) will be convened between the Principal Contractor, National Highways' Historic Environment Manager, the Archaeological Contractor, the relevant Local Authority Archaeological Advisors and (if appropriate) Historic England or other key stakeholders. The site consultation meeting will consider the specific nature of any unexpected archaeological remains and the potential impacts of any construction activity on the unexpected archaeological remains. The outcomes of this meeting will inform any further archaeological work and the extent of any stand-off beyond 10m that may be required.
- 7.1.15 In accordance with Requirement 9 of the Draft Development Consent Order (Application Document 3.1), any unexpected finds must be retained in situ and reported to the relevant planning authority as soon as reasonably practicable. No construction can take place for 14 days from the date of such finds being reported unless otherwise agreed in writing by the Secretary of State. If the relevant planning authority finds that further investigation is needed, no construction shall take place within a minimum of 10 metres of the remains, until

further investigation and recording including details to be agreed by the Secretary of State and approved by the relevant planning authority.

7.2 Communication, monitoring and sign-off

Communication

- 7.2.1 On a Project of this size, effective communication between all parties is essential. A communication strategy for external communications about the archaeological mitigation will be developed and implemented.
- 7.2.2 Regular progress meetings will be held during the programme of archaeological mitigation works between key stakeholders, including the Local Authority Archaeological Advisors and Historic England, the relevant Archaeological Contractor(s), the ACoW, the National Highways Historic Environment Manager, other National Highways staff as relevant and Principal Contractor(s) as relevant.
- 7.2.3 The purpose of these meetings will be to update all the stakeholders on progress on archaeological mitigation across the Project, to share best practice and to ensure the overall direction of the archaeological mitigation works are carried out in line with the principles of this document.
- 7.2.4 Prior to the implementation of archaeological mitigation works as set out in each SSWSI, a meeting will be held between the ACoW, the National Highways Historic Environment Manager, the relevant Archaeological Contractor(s), the Local Authority Archaeological Advisors and the Principal Contractor.
- 7.2.5 Prior to the implementation of historic buildings dismantling and recording works as set out in the relevant SSWSI, a meeting will be held between the ACoW, the National Highways Historic Environment Manager, the relevant Archaeological Contractor(s), the Local Authority Historic Buildings Advisors, Historic England and the Principal Contractor.
- 7.2.6 The purpose of these meetings will be to agree the overall strategy for the delivery of the works as set out in the relevant SSWSI, the initial monitoring programme by the Local Authority Archaeological Advisor or Local Authority Historic Buildings Advisor and to share any relevant information not captured within the SSWSI or method statements.

Monitoring

- 7.2.7 Site monitoring has two dimensions, firstly, the day-to-day liaison and monitoring between the ACoW and the Archaeological Contractor, National Highways Historic Environment Manager, and the Principal Contractor(s) (as relevant) to monitor progress and compliance with the requirements of the SSWSIs, and secondly the monitoring of the archaeological mitigation works by the Local Authority Archaeological Advisors or the historic buildings dismantling and recording works by the Local Authority Historic Buildings Advisors.
- 7.2.8 The first dimension will include (but not be limited to):
- a. Monitoring of all aspects of archaeological fieldwork

- b. Monitoring of the installation and removal of protective measures, such as temporary fencing, and at sites where preservation of archaeological remains is required

- 7.2.9 The archaeological mitigation works will be subject to ongoing monitoring by the ACoW, who will have unrestricted access to the sites, site records or any other information as may be required. The work will be inspected to ensure that it is being carried out to the required standard and that it will achieve the desired aims and objectives.
- 7.2.10 The ACoW will report to National Highways Historic Environment Manager on the archaeological mitigation works on a weekly basis.
- 7.2.11 The second dimension will ensure that archaeological mitigation works meets the requirements of each approved SSWSI.
- 7.2.12 Local Authority Archaeological Advisors are required to monitor the works and associated records as they are carried out. The frequency of monitoring visits will depend on the complexity of the works and significance of any archaeological deposits.
- 7.2.13 The Local Authority Archaeological Advisors will be afforded access to the archaeological works and any other information, which will be arranged as necessary and required through the ACoW who will act as coordinator in respect of access and monitoring arrangements.
- 7.2.14 Where a SSWSI needs to be amended for any reason, the Local Authority Archaeological Advisors (and Historic England if appropriate) and the Principal Contractor(s) will be consulted on any alterations to the agreed SSWSIs prior to them being undertaken.
- 7.2.15 Local Authority Historic Buildings Advisors are required to monitor the historic buildings dismantling and recording works and associated records as they are carried out. The frequency of monitoring visits will depend on the complexity of the works and significance of the building.
- 7.2.16 The Local Authority Historic Buildings Advisors will be afforded access to the historic buildings dismantling and recording works and any other information, which will be arranged as necessary and required through the ACoW who will act as coordinator in respect of access and monitoring arrangements.
- 7.2.17 Where a SSWSI needs to be amended for any reason, the Local Authority Historic Buildings Advisors (and Historic England if appropriate) and the Principal Contractor(s) will be consulted on any alterations to the agreed SSWSIs prior to them being undertaken.
- 7.2.18 The National Highways Historic Environment Manager will act as coordinator of engagement between the Archaeological Contractor(s) and the relevant heritage stakeholders, to ensure the timely provision of on-site advice to the fieldwork team.

Site sign-off

- 7.2.19 It is acknowledged that the programme of works will require authentication of completion and the following approach is proposed.

- 7.2.20 Once the Archaeological Contractor determines the fieldwork to be completed, a sign-off meeting will be held on site (unless alternative communication is agreed) between the ACoW, the National Highways Historic Environment Manager, Local Authority Archaeological Advisors (and Historic England if appropriate) the Archaeological Contractor(s) and the Principal Contractor(s).
- 7.2.21 The purpose of this meeting is to agree that the archaeological mitigation works have been carried out to the satisfaction of all parties prior to the formal sign-off by the Local Authority Archaeological Advisors.
- 7.2.22 Sites that have been completed will be subject to a formal signing off procedure. The Archaeological Contractor will submit a completion statement to the ACoW. The ACoW will submit the accepted completion statement to the National Highways Historic Environment Manager and the appropriate Local Authority Archaeological Advisor for confirmation (in consultation with Historic England where required) that the relevant works have been completed in compliance with the relevant SSWSIs.
- 7.2.23 In the event of disagreement between the Archaeological Contractor, the ACoW, the relevant Local Authority Archaeological Advisor and/or the National Highways Historic Environment Manager on the progress, strategy or completion of work, a form of arbitration will be proposed.
- 7.2.24 The National Highways Historic Environment Manager will act as coordinator of engagement between the Archaeological Contractor(s) and the relevant heritage stakeholders, to ensure the sign-off meeting is held in a timely manner.

Interim Statements, post-excavation reporting and publication

- 7.2.25 The Local Authority Archaeological Advisors, where appropriate the Local Authority Historic Buildings Advisors and Historic England will review Interim Statements, the Post Excavation Assessment Report (PEAR), specialist reports and publications.
- 7.2.26 The PEAR will be approved by the SoS following consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors), Historic England and the Lower Thames Crossing Heritage Research Group.
- 7.2.27 Details of the Interim Statements, post-excavation reporting and publication are set out in Section 8.

7.3 Methodology for each technique

Preservation of archaeological remains

Burial or sealing of archaeological remains

- 7.3.1 At some locations along the Project, suitable fill material on top of a protective barrier membrane as identified in the SSWSI will be used to bury sensitive archaeological remains, to ensure that they are not disturbed during construction. Sites will be temporarily buried beneath fill to enable specific construction requirements, e.g. soil storage, some compounds or some temporary roads.

- 7.3.2 The Archaeological Contractor(s) will include in the SSWSI methods that they intend to use to protect sensitive buried archaeological remains, including measures to prevent damage (such as deep rutting) caused by vehicles or plant. This will include detail on the effects of compression and loading (whether dynamic or static) and site specific protective measures, including the extent of the area to be protected, the depth of fill required and the type of fill. The SSWSIs will set out suitable methodologies for filling areas without disturbing or impacting sensitive archaeological remains, and for removing the fill at the end of construction.
- 7.3.3 The preservation methodology in the SSWSI will be developed in line with the principles of Historic England's 'Preserving Archaeological Remains' guidance in consultation with the National Highways Historic Environment Manager, the ACoW and the Local Authority Archaeological Advisors. At each site, measures will be put in place to avoid rutting or the compaction of soft ground (topsoil and fill) until or unless adequate protection is provided (vehicles will be restricted or prohibited from traversing sensitive areas prior to fencing, the laying of a protective membrane and fill deposits/vehicle running surface, and at decommissioning).
- 7.3.4 The methodology used to allow for the preservation of archaeological evidence was as follows:
- A layer of 10 mm pea shingle was used to fill in any gaps or undulations in the surface of the archaeological remains to a depth of 500 mm above the highest level of the archaeological remains. This ensured that any archaeological features were fully infilled. This was pushed over the remains using a D3 low ground pressure machine.
 - A layer of geotextile was laid over the shingle by hand.
 - Above the geotextile layer, normal embankment construction proceeded.
- 7.3.5 This methodology should form the basis of the preservation methodologies prepared by the Archaeological Contractor and set out on in the relevant SSWSI.
- 7.3.6 The ACoW will give Tool Box Talks to inform all site personnel of the archaeological and historic environment constraints on site, the protection measures that are required and their obligations under the SSWSI, and generally to ensure that these are put in place and complied with. Following construction, the protective fill material will be removed by the Principal Contractor(s), under supervision by the Archaeological Contractor(s), leaving the sites in their original condition.

Protective fencing

- 7.3.7 To demarcate those sites that require preservation of archaeological remains and to avoid unintentional damage during construction, temporary fencing will be installed during the start of the construction stage (check when the fencing is going up). The fencing will be installed by a fencing contractor under the supervision of the relevant Archaeological Contractor(s)

- 7.3.8 The location and type of fencing for each site for preservation of archaeological remains will be set out in a MS (it may be helpful for the Archaeological Contractor(s) to combine various sites into a single MS). It will also set out whether any preliminary archaeological investigative work is required (before or during the installation or removal process). Requirements for archaeological investigation will be contained within the SSWSIs.
- 7.3.9 The ACoW will be responsible for regularly monitoring the condition of the fencing and the Principal Contractor(s) will be responsible for its maintenance until either construction work in that area is complete or at Project opening, at which time the removal of the fencing will be monitored by the ACoW

Recording of above ground heritage assets

Archaeological topographic/earthwork survey

- 7.3.10 Topographic survey is a technique used to record, in detail, the precise surface topography, form, character, nature, layout, detail and complexity of individual and groups of earthwork features that are present in the existing landscape. The survey will be carried out to record the topography, where specified, prior to its alteration by construction or related activities. The record will include production of feature profiles, contour and/or hachure plans and a photographic record, where appropriate.
- 7.3.11 The archaeological topographic survey will be carried out in accordance with SSWSIs to be prepared by the APT Archaeological Surveyor which will describe the research aims and objectives and will be developed in consultation with the National Highways Historic Environment Manager and the relevant Local Authority Archaeological Advisors, prior to works commencing in the area to which each SSWSI applies. Each SSWSI will be written in accordance with DMRB (LA116), and Historic England guidance including Understanding the Archaeology of Landscapes (Historic England, 2017b), Traversing the Past (Historic England, 2016b), Metric Survey Specification for Cultural Heritage (Historic England, 2015b), Using Airborne Lidar in Archaeological Survey (Historic England, 2018c), and will also adhere to all current and relevant best practice and standards and guidelines. The SSWSIs will set out the requirements for both digital and paper outputs.
- 7.3.12 Depending upon ground conditions and survey methodology it may be necessary to remove vegetation before a survey. This would be done under archaeological supervision in accordance with a Method Statement to ensure the clearance is done in a controlled manner and does not impact on the remains.

Photographic recording

- 7.3.13 Photographic recording will be undertaken before and after vegetation clearance. The photographic record will be commensurate with Historic England's Level 1 record (Historic England, 2016a). It will include general and specific views of the site (even if there are no visible remains), to record its appearance, condition and to give an impression of the size and shape of the site and to record details such as dates or inscriptions, any signage, marker plates or graffiti (milestones/stones). The basic visual record will be

supplemented by a written account (descriptive record) that provides a basic context to the photographic record.

Historic buildings recording

- 7.3.14 The building recording will be carried out in accordance with Historic England's guidance *Understanding Historic Buildings*; a guide to good recording practice (Historic England, 2016a). The survey level will be at Level 3 for non-designated historic buildings and at Level 4 for three Grade II Listed Buildings, as defined in that document.

Level 3 historic buildings recording

- 7.3.15 Level 3 is an analytical record, comprising an introductory description followed by a systematic account of the building's origins, development and use. The record will include an account of the evidence on which the analysis has been based, allowing the validity of the record to be re-examined in detail. It will also include all drawn and photographic records that may be required to illustrate the building's appearance and structure and to support an historical analysis.
- 7.3.16 Access will be provided to the historic buildings identified in Table 9.3 prior to their demolition to allow for a thorough examination of the building's external and internal fabric. Areas that will be examined prior to demolition include all accessible internal rooms and the roof space.
- 7.3.17 A second phase of recording will be undertaken during demolition as a watching brief. This will record any elements previously concealed within the building.
- 7.3.18 The Level 3 Historic Buildings Survey will be carried out in accordance with SSWSIs to be prepared by the Historic Buildings specialist employed by the relevant Archaeological Contractor, which will describe the research aims and objectives and will be developed in consultation with the National Highways Historic Environment Manager and the relevant Local Authority Historic Buildings Advisors, prior to works commencing in the area to which each SSWSI applies.

Level 4 historic buildings recording

- 7.3.19 Level 4 provides a comprehensive analytical record and is appropriate for buildings of special importance. Whereas the analysis and interpretation employed at Level 3 will clarify the building's history so far as it may be deduced from the structure itself, the record at Level 4 will draw on the full range of other sources of information about the building and discuss its significance in terms of architectural, social, regional or economic history. The range of drawings may also be greater than at other levels.
- 7.3.20 Level 4 Historic Buildings Recording has begun on the three Grade II Listed Buildings identified in Table 9.3, to inform the assessment of their significance and are available in Appendix 6.16 to ES Chapter 6 (Application Document 6.3).
- 7.3.21 A second phase of recording will be undertaken during demolition as a watching brief. This will record any elements previously concealed within the building.
- 7.3.22 The Level 4 Historic Buildings Survey will be carried out in accordance with SSWSIs to be prepared by the Historic Buildings specialist employed by the relevant Archaeological Contractor, which will describe the research aims and objectives and will be developed in consultation with the National Highways

Historic Environment Manager and the relevant Local Authority Historic Buildings Advisors, prior to works commencing in the area to which each SSWSI applies.

Intrusive archaeological fieldwork

Topsoil artefact sampling

- 7.3.23 Artefactual evidence in the topsoil may represent a substantial proportion of the archaeological evidence for earlier prehistoric periods, in particular Mesolithic, Neolithic, and Early Bronze Age material. The strategy for ploughzone artefact collection will be developed with a specific emphasis on the Research Framework and how the artefactual resource within the ploughzone can contribute to and identify specific research questions that they have the potential to answer. Ploughzone artefact collection will be undertaken through topsoil sieving of a gridded test pitting programme within specific areas where the archaeological trial trenching suggest that significant amounts of artefactual evidence may be present. These are set out in Table 9.1 and Table 9.2. The results of the surface artefact collection will inform the development of SSWSIs for the proposed archaeological mitigation.
- 7.3.24 The results of any fieldwalking and ploughzone artefact collection will be reviewed alongside the Research Framework and proposals for further artefact sampling developed in consultation with the National Highways Historic Environment Manager, the ACoW, the relevant Local Authority Archaeological Advisors and if appropriate, Historic England.
- 7.3.25 The scope of the work will be set out in each SSWSI, prepared by the relevant Archaeological Contractor in consultation with the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors and, if appropriate, Historic England. The application of the sampling strategy will be developed as an iterative process at site consultation meeting(s) between the Archaeological Contractor(s) the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors.
- 7.3.26 In some areas the scale of the test pitting would be such that use of a bulk wet sieving system, rather than dry hand-sieving may be preferred. Depending on the system adopted, this could entail washing of topsoil samples from the test pits through sieving plant set up on site or at a suitable compound location, with the retained coarse fraction dried, weighed, bagged, labelled and logged, before detailed sorting and assessment to inform development of the test pitting strategy in line with the principles set out above. Any decision on the adoption of a mass bulk wet-sieving system will consider the potential impact on vulnerable artefact types such as ancient metalwork or prehistoric pottery.
- 7.3.27 The Archaeological Contractor(s) will set out in a Method Statement how they would achieve the level of performance necessary to process a large amount of topsoil, in consultation with National Highways Historic Environment Manager, the ACoW, the Main Works Contractor and the relevant Local Authority Archaeological Advisors.

Detailed excavation

General approach

- 7.3.28 The aims of detailed archaeological excavation (AMS 4.2) is set out in Table 3.1 and the approach summarised in Paragraphs 6.4.26 – 6.4.33 above. The following general approach will apply for detailed archaeological excavation.
- 7.3.29 Sites that require investigation will be those that are identified in Table 9.1 and Table 9.2 but may also include new areas that arise as a result of emerging results, detailed design and unexpected discoveries.
- 7.3.30 Sites designated for detailed archaeological excavation will be stripped with mechanical plant as set out in the SSWSI except in areas where further ploughzone sampling is taking place. The sequencing of stripping, location of soil storage areas and arrangements for backfilling, together with other relevant logistical considerations, will be set out in a Method Statement (see section 7.1 above).
- 7.3.31 For sites where machine stripping is required (following completion of any ploughzone sampling), topsoil, subsoil and other overburden will be removed by the relevant Archaeological Contractor(s) to the correct archaeological horizon under archaeological supervision. The relevant horizon will be informed by the evaluation results, the Research Framework (refer to Chapter 5), and the aims and objectives described in the SSWSIs.
- 7.3.32 In accordance with the research aims and objectives outlined in the Research Framework (Chapter 5), which will be further developed through the identification of site specific aims and objectives within the SSWSI's in consultation with relevant APT specialists, the archaeological site will then be subject to hand excavation of key features designed to recover artefactual and scientific dating evidence. All specialist samples will be accurately located in three dimensions. At the same time selected feature complexes would be subject to further hand excavation designed to resolve stratigraphic relationships.
- 7.3.33 The works will also include sampling of archaeological remains for palaeoenvironmental and palaeoeconomic indicators (for example, charred plant remains, molluscs, pollen, etc.) (see Paragraphs 7.3.67 to 7.3.76 below, Environmental Sampling Strategy), in accordance with the SSWSI and the Research Framework. Artefact and palaeo-environmental assessments will be carried out during the course of the fieldwork; selected key features/structures will be subject to more detailed excavation and sample recovery to address the evolving research objectives of the archaeological programme.
- 7.3.34 The proportion of features excavated will be determined by the significance of the remains and the requirements of the research objectives set out in the SSWSI. This iterative process is intended to allow the approach to excavation sampling to be both flexible and closely targeted to address specific questions, rather than being tied to a pre-determined excavation strategy. The proportion will be determined in consultation with the National Highways Historic Environment Manager.
- 7.3.35 The research objectives and excavation strategy will be kept under review during the investigation at each site. In order to facilitate this approach, relevant

data, artefact and environmental sample processing will be undertaken whilst the investigation proceeds on site (including artefact spot-dating and preliminary assessment of environmental samples). The preliminary assessment of materials, including faunal remains, ecofacts and palaeoenvironmental proxies recovered from samples, undertaken whilst the investigation is underway will support the outlined iterative approach to sampling. Decisions on further investigation at a given site will be made once sufficient information becomes available.

- 7.3.36 Palaeo-environmental sampling and environmental sequences of Pleistocene date have the potential to recover information about past human environmental interactions, human activities and evidence of environmental change. Waterlogged deposits or sequences where waterlogged deposits are present within a sequence will receive particular attention. Such deposits may also preserve organic artefacts and textiles which are not ordinarily preserved in dry conditions. If waterlogged deposits are identified, the Conservation specialist and the Environmental Archaeology Coordinator or Environmental Archaeology Supervisor will be contacted for advice in the first instance, and the and the National Highways Historic Environment Manager, the ACoW, the Principal Contractor, the Historic England Regional Science Advisor and the relevant Local Authority Archaeological Advisors will be notified. Special consideration will need to be given to other construction activities in the vicinity when considering the impact of works on waterlogged deposits. The process as set out in Paragraphs 7.1.4 and 7.3.36 applies to all waterlogged deposits.
- 7.3.37 Geo-archaeological investigations (see Paragraphs 7.3.102 to 7.3.117) will focus on areas of particular interest as identified through previous and current archaeological evaluations, and in the Research Framework, and will be specifically designed to address particular research questions. The National Highways Historic Environment Manager, the ACoW, the Local Authority Archaeological Advisors and, if appropriate, Historic England will be contacted by the Archaeological Contractor(s) and consulted about an appropriate sampling strategy and to comment on site retrieval methods. The sampling methodologies and specific research questions for Geoarchaeological Investigations will be clearly outlined in the SSWSI for each relevant area.
- 7.3.38 The Archaeological Contractor(s) shall not excavate any area beyond those identified within the relevant SSWSI. Should archaeological features revealed within the excavation area continue outside of the area and are likely to be subject to construction impact, the excavation area may need to be extended to fulfil the requirements of the DCO and NPSNN. This will only be undertaken with the agreement of National Highways Historic Environment Manager, the ACoW and the Principal Contractor, in consultation with the relevant Local Authority Archaeological Advisors.

Machine excavation

- 7.3.39 Detailed archaeological excavation will be carried out at the locations identified in the SSWSIs. Each detailed archaeological excavation area will be positioned using electronic survey-grade equipment. The initial stage of excavation will be undertaken using a 360° mechanical excavator or other similar back-acting plant fitted with a toothless bucket, used in such a manner as to expose cleanly the archaeological surface. The Archaeological Contractor(s) shall ensure that

hired-in plant and operators have the capability to achieve a consistently high standard of work. All operatives will receive an induction outlining the nature of any archaeological remains likely to be encountered and the expectations of the Archaeological Contractor(s), Principal Contractors, the wider Project Team, and National Highways. The MSs and SSWSIs for each site will include proposals for the stockpiling, handling and replacement of topsoil with reference to any Soils Management Strategy and Soils Handling Strategy.

- 7.3.40 Machine excavation will proceed under the direct supervision of the Archaeological Contractor(s) in level spits, until either the top of the first archaeological horizon or undisturbed natural deposits are encountered (the decision to employ spits will be set out in each SSWSI). Particular attention will be paid to achieving a clean and well-defined horizon with the machine. Under no circumstances will the machine be used to cut arbitrary trenches down to natural deposits. The mechanical excavator will not be permitted to traverse any stripped areas.
- 7.3.41 The surface achieved through machine excavation will be inspected for archaeological remains. The resulting surface will be cleaned by hand in order to identify or define the extent of archaeological remains present. Areas where hand cleaning is likely to be required will be identified in the SSWSI: decisions regarding where additional hand cleaning is required will be made on site.
- 7.3.42 The extent of the area of detailed archaeological excavation will be clearly demarcated to ensure that persons or vehicles cannot inadvertently traverse the area of investigation whilst archaeological works are in progress; the method of demarcation will be set out in the MS for the archaeological work and in the SSWSI. Dump trucks and other plant will not be permitted to track over stripped areas until archaeological investigations at that location are complete and the archaeological site is signed-off for construction. All fencing/bunds associated with the archaeological works area will be regularly inspected by the ACoW and maintained by the Main Works Contractor until the archaeological works in that area have been completed, inspected and approved as set out in Paragraphs 7.3.1 to 7.3.9.
- 7.3.43 Topsoil will be subject to a rapid metal detector scan prior to stripping, to identify and recover metal objects within the topsoil. All archaeological metal artefacts (except those that cannot be X-rayed, such as lead artefacts) will be subject to X-ray, which will be used to rapidly scan material for retention or disposal (with reference the ClfA selection toolkit). The APT Finds co-ordinator/processing specialist and the Conservation specialist will be consulted. Stripped surfaces and archaeological features will also be subject to a rapid metal detector scan to identify loose artefacts from uncleaned surfaces, and on cleaned surfaces to help identify areas for careful excavation. Hand-excavated spoil will also be scanned. This will be undertaken by an appropriately qualified or experienced metal detectorist. The SSWSIs will set out how metal detecting will be used as part of the artefact recovery strategy for individual sites. Provision will also be made for 3D location recording of artefacts within features, but also within unstratified deposits where significant quantities are identified. The Archaeological Contractor(s) will consider the use of metal detecting at the end of each day in order to assist in site security.

Hand excavated trenches and hand excavated test pits

- 7.3.44 Hand excavated trenches and test pits will be opened using hand tools instead of mechanical plant in circumstances where sensitive/fragile archaeological remains are predicted to survive based on the results of ploughzone artefact sampling and/or trial trenching. These circumstances may include, for example, in situ lithic assemblages whose fabric could be damaged by the use of mechanical equipment, or distortion of spatial distributions, or where the scale of the investigations is significantly smaller, or where greater control is required (for example where deposits of buried colluvium have been exposed).
- 7.3.45 Hand excavation will be used to establish the presence/absence of remains/artefact distributions, the extent and condition of the remains or concentrations of artefacts, and to inform additional mitigation requirements. It may be necessary to limit the depth of the investigation so as not to compromise the integrity of a high value potential resource, such as a buried ground surface. Hand excavation will be conducted with due regard to the potential survival of cultural material at the interface with the topsoil and the potential survival of microtopographic features, as identified in the SSWSIs. It may also be necessary to excavate deposits using spits of pre-determined thickness to allow cross-site comparisons with work undertaken at the evaluation stage. The proposed use of spits will be set out in the SSWSIs.

Artefact recovery strategy

- 7.3.46 As well as the routine collection of artefacts that will be carried out during normal site works, other techniques may be deployed as identified in the SSWSI, to recover datasets relevant to the investigation and site specific or Scheme-wide research objectives.
- 7.3.47 The Archaeological Contractor will consult the APT specialists during the preparation of the SSWSIs, regarding the artefact recovery strategy. If changes are required during the course of the investigation at a site, then these will be developed as an iterative process at site consultation meeting(s) between the Archaeological Contractor(s) the National Highways Historic Environment Manager and the relevant Local Authority Archaeological Advisors.

Excavation sampling strategy

- 7.3.48 Archaeological features, layers or deposits identified for excavation will be hand excavated in an archaeologically controlled and stratigraphic manner, to meet the aims and objectives of the investigation as set out in the SSWSIs. Machine assisted excavation of large deposits will only be permitted at the discretion of the National Highways Historic Environment Manager, in consultation with the relevant Local Authority Archaeological Advisors. Sufficient deposits/features will be investigated through hand excavation in each archaeological excavation area to record the horizontal and vertical complexity of the stratigraphic sequence to the level of underlying sterile geological strata. Excavation will also target the inter-relationships between features and major feature intersections to understand and record their relationships.
- 7.3.49 The excavation sampling strategy will be dictated by the significance of the remains, their stratigraphic complexity and their artefactual and palaeoenvironmental content (including absence of artefactual content). The

Archaeological Contractor(s), in consultation the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors and, if appropriate, Historic England will describe in their SSWSIs an appropriate sampling strategy as determined by the results of the archaeological evaluation and key research questions, prior to works commencing in the area to which the SSWSI applies.

- 7.3.50 The strategy will be kept under review during the investigation. Site data, artefact and environmental sample processing will be undertaken whilst the investigation proceeds on site (including artefact spot-dating and preliminary assessment of environmental samples). Initially, the minimum sample sizes will be implemented on site by the Archaeological Contractor(s) in accordance with the approved SSWSI. The reflexive process will allow the recovery of finds and samples for dating and assessment for their palaeoenvironmental and geoarchaeological potential. Changes to the strategy will be developed as an iterative process at site consultation meeting(s) between the Archaeological Contractor(s) the National Highways Historic Environment Manager and the relevant Local Authority Archaeological Advisors.
- 7.3.51 The following minimum sampling requirements will be used as a standard, within the iterative excavation sampling strategy; these may be varied to suit the research value of the remains, subject to agreement with the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors and, if appropriate, Historic England at a site consultation meeting. The SSWSI will identify the initial minimum sample for excavation.

Linear features

- 7.3.52 Sufficient sections though linear features will be targeted in key locations to address research questions. It may be necessary to increase percentage excavation to address research questions where a higher volume sample would achieve this. Segments will be hand excavated along the length of the feature to understand its depositional sequence and character. Each segment will be not less than 1m long and will be regularly spaced along its length. Segments will be located away from intersections with other features, although key intersections will also be targeted to provide an understanding of the deposit sequence and the relationship between different feature types/classes. All ditch ends will be investigated. A minimum of 20% of each linear feature will be excavated (increasing to 40% for enclosure ditches and 100% for smaller curvilinear features).

Discrete features

- 7.3.53 Pits, post-holes and other isolated features (including natural features that have been shown to contain archaeological remains) will normally be completely (100%) excavated (unless otherwise agreed in consultation with the National Highways Historic Environment Manager and the Local Authority Archaeological Advisors, half - sectioning of features may be adopted, in consultation with National Highways Historic Environment Manager and the Local Authority Archaeological Advisors, subject to the significance of the remains and the research questions identified in the SSWSIs.

Buried ground surfaces, floor surfaces and hearths

7.3.54 Buried ground surfaces, floor surfaces and hearths have the potential to contain important remains, including finds distributions, ecofacts and palaeoenvironmental remains. It may be possible to recognise individual turves or deposits representing dumped material: if laminated sequences are identified e.g. turves, the APT Geoarchaeologist will attend site with the APT Environmental Specialist to devise a sampling strategy, which may include recovery of monoliths. Grid sampling and bulk sampling may be adopted depending upon the significance of the remains and the research questions identified in the SSWSIs. Hearths and areas of in situ burning will be completely excavated (in plan or by quadrant) and sampled for palaeoenvironmental remains and to recover material suitable for scientific dating, such as archaeomagnetic dating, to address key research aims.

Animal bone groups

7.3.55 Where structured deposits or animal bone groups are identified during excavation, the Archaeological Contractor will follow Historic England guidance 'Animal bones and Archaeology: Recovery to archive' (Historic England, 2019c) and will consult with the National Highways Historic Environment Manager and the Local Authority Archaeological Advisors.

Structures

7.3.56 Each structure, including stone structures, will be investigated/sampled to define the extent, form, stratigraphic complexity and depth of the component features and its associated deposits. Intersections between components will be investigated to determine their relationship(s). Particular care will be taken to ensure that areas of in situ burning are not investigated prior to the consideration of scientific dating.

7.3.57 If dwelling structures are found or suspected after topsoil stripping, careful hand cleaning will be undertaken at the level of initial definition to establish the full extent of the structure and any associated or related contemporary features, to understand its complexity, state of preservation, significance and to contribute to answering research questions set out in the SSWSIs. It may be necessary to re-clean areas to achieve an acceptable level of feature definition. Features/contexts that are part of the structure or which may have contributed to its construction (such as drip gullies, post holes, internal or external surfaces, hearths, etc.) will be 100% excavated. Contexts will be routinely sampled for ecofacts, palaeoenvironmental remains and dating material.

7.3.58 The hand excavation of wells, or similar deep structures, will only proceed following a safe working practice, as required by national health & safety guidance, and as recorded in the MS to be prepared by the Archaeological Contractor and approved by the National Highways Historic Environment Manager, the ACoW and the relevant Main Works Contractor. Preliminary hand augering of potential deep deposits may be able to identify depth and would inform an excavation strategy which may include machine excavation or stepping-out to ensure that there is no depth restriction in areas subject to archaeological mitigation. The excavation sampling strategy will be developed at site consultation meeting(s) between the Archaeological Contractor(s) National Highways Historic Environment Manager and the relevant Local Authority Archaeological Advisors.

Burials

- 7.3.59 Burials (including features suspected of being burials) will be investigated in accordance with the strategy for the recovery of human remains (see Paragraphs 7.3.82 to 7.3.92 below).

Tree hollows

- 7.3.60 Tree hollows were encountered in some evaluation areas, some may relate to historic ploughing, topography and drainage, or possibly to specific prehistoric land use. The distribution of tree hollows has potential to contribute to studies of landscape evolution and change across the landscape. The comprehensive mapping and investigation of a representative sample of tree throws for artefactual, ecofactual and palaeoenvironmental evidence is therefore proposed, comprising:
- Mapping and investigation of all possible tree hollows encountered in mitigation areas (i.e. interpretation);
 - Archaeological excavation of a sample of confirmed tree hollows; and
 - Recovery of a sample of 150 litres of the fill of excavated tree hollows to be sieved for small artefact recovery. If sieving produces significant quantities of settlement debris, particularly hazelnut shell, then flotation samples will also be processed.

Recording

- 7.3.61 Once open, the extent of the excavation area(s) will be accurately recorded using metric survey grade equipment (or its equivalent) and fixed in relation to any existing survey markers. The data will be overlaid onto the Ordnance Survey national grid (using digital map data).
- 7.3.62 Following cleaning, the archaeological remains will be mapped (electronic survey grade equipment) and planned to enable the selection of areas and features for investigation and to compare the position of the identified archaeological remains with any available previous geophysical, aerial photographic, trial trench data, as applicable.
- 7.3.63 A full written, drawn and photographic record will be made of the archaeological remains, in accordance with the Archaeological Contractor's recording system and standard archaeological methodologies.
- 7.3.64 The Archaeological Contractor(s) will be expected to use digital recording methods to ensure the smoothest transfer of information between the on-site work and the Local Authority Archaeological Advisors.
- 7.3.65 Hand-drawn plans and sections of features will be produced. The minimum acceptable scale will be 1:50 or 1:20 for plans and 1:10 for sections. Human burials and other special deposits, such as animal bone groups will normally be drawn at a scale of 1:10 or 1:5. All plans and sections will be accurately located against the site grid using electronic survey equipment and will include spot heights relative to Ordnance Datum in metres and will be expressed to a minimum of two decimal places. The Archaeological Contractor(s) will include in their SSWSI a statement that describes their recording system and the accuracy of their site mapping.

7.3.66 Site photography will be used to record all archaeological remains that are under investigation. In addition, photographs will be taken to assist in interpretation and publication, and to give an overview of the site, the progress of the investigations and site activities. Overhead (drone) photography will also be used to record progress, relationships between structures and to put the investigations within a wider landscape context. Particular attention will be paid to obtaining photographs suitable for displays, exhibitions and other publicity material.

Environmental sampling strategy

7.3.67 Each APT Environmental Archaeology Coordinator will develop the detailed environmental sampling strategy in consultation with all relevant specialists and will oversee the work at the fieldwork stage. The Environmental Archaeology Coordinator will liaise with the variety of specialists who may be involved, to develop fully the strategy and tactics for environmental research and to ensure the smooth running of this aspect of the investigations. The nominated Coordinator may be a member of the Archaeological Contractor's specialist team responsible for a particular aspect of the proposed work (such as geo-archaeologist), with suitable experience and training and the ability to convey accurate information about a site and the deposits to specialists. The APT Environmental Archaeology Coordinator will be present at site visits and meetings with the National Highways Historic Environment Manager and Local Authority Archaeological Advisors as necessary.

7.3.68 In addition to the APT Environmental Archaeology Coordinator, an Environmental Archaeology Supervisor will be nominated to take charge of the routine processing of samples and the supervision of routine sampling in connection with the investigations.

7.3.69 The detailed environmental sampling strategy for each SSWSI will be based upon the results of previous assessment work and the potential of the materials to address key research questions. APT specialists (such as a zooarchaeologist for animal bones, archaeobotanist for charred plant remains, archaeomalacologist for molluscs), National Highways Historic Environment Manager and Local Authority Archaeological Advisors will be consulted regarding site specific requirements.

7.3.70 Environmental sampling will be carried out in accordance with current national guidelines including Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-Excavation (English Heritage, 2011), Geoarchaeology, Using earth sciences to understand the archaeological record (Historic England, 2015), and the current ClfA Standard and guidance for the collection, documentation, conservation and research of archaeological materials (ClfA, 2014).

7.3.71 The processing of samples and their assessment will feed back into the sampling strategy that is employed in the field. The processing and initial assessment of all samples (except for specialist samples) would be undertaken at a site compound to facilitate the rapid feedback to the field team. Processing will be supervised by the Archaeological Contractor's finds coordinator/processing specialist.

- 7.3.72 All flotation samples and coarse sieved samples should be processed and assessed to inform the sampling strategy within a timescale agreed between the Archaeological Contractor and the National Highways Historic Environment Manager, but not greater than two weeks, except for specialist samples which will need a specific approach. Finds, ecofacts and biological artefacts from sample residues should be recorded to sample fraction.
- 7.3.73 The aims of the environmental strategy will be to address the Research Framework. Site based studies that could aid the investigations will include the following (this list is not exhaustive and other studies may be relevant):
- a. Pedological (including micromorphology) study of soils (or other suitable deposits) deeply buried beneath or within colluvium would provide information relating to the status of the soil at the time of burial and should be able to detect and characterise aspects of previous land use and will provide information on erosion and on the contribution of colluvium and wind-borne material to the soil.
 - b. Pollen and diatom/phytolith analysis.
 - c. Detailed wet sieving/flotation of buried ground surfaces and other selected contexts and features for the recovery of charcoal/wood, plant macrofossils, small animal bones, molluscs, coleoptera, small artefacts etc. The retrieval of a reliable sample will be achieved by the routine sampling of a set proportion of each selected context/deposit excavated. Sampling will also be systematic and extensive.
- 7.3.74 All samples taken will come from suitably cleaned surfaces and will be collected with clean tools and placed in clean containers, in consultation with relevant APT specialists. They will be recorded and labelled in accordance with national, and a register of all samples will be kept. Once the samples have been obtained, the Environmental Archaeology Coordinator and the Finds Coordinator will ensure that they are placed in safe storage under suitable conditions to prevent deterioration prior to them being sent to the appropriate specialist.
- 7.3.75 If organic rich archaeological remains are encountered during the investigations, the APT Environmental Archaeology Coordinator will be contacted for advice and to devise an appropriate strategy for excavation and sampling. In addition, the Archaeological Contractor will inform the ACoW and National Highway Historic Environment Manager immediately, who will then notify the Main Works Contractor and National Highways.
- 7.3.76 Environmental assessment at the reporting stage will include consideration of scientific methodologies alongside traditional recording. For example, zooarchaeological assessment will include the potential of biomolecular methodologies where there is a clear research question which could be addressed through biomolecular analysis, determined through the assessment of animal bones. The Archaeological Contractor will consult with the National Highway Historic Environment Manager, the relevant Local Authority Archaeological Advisors and the Historic England Regional Science Advisor.

The National Highway Historic Environment Manager will approve the proposals for scientific study at the assessment and analysis stages, in consultation the relevant Local Authority Archaeological Advisors and the Historic England Regional Science Advisor. Samples for radiocarbon dating will be identified from material sampled for environmental analyses.

Strategy for scientific dating

- 7.3.77 Statistical modelling will be combined with a comprehensive scientific dating programme and the archaeological evidence to address the ARA and the aims and objectives identified in the SSWSIs. Each APT Scientific Dating Specialist will develop the detailed strategy for scientific dating in consultation with all relevant specialists, the Historic England Regional Science Advisor the relevant Local Authority Archaeological Advisors and the National Highway Historic Environment Manager. The APT Scientific Dating Specialist will devise a strategy (prior to the commencement of the works to which the dating strategy will apply) so that it can be incorporated into the SSWSIs to ensure that the right contexts are excavated and to ensure a comprehensive programme of scientific dating is possible, with specific research objectives. Although scientific dating will be undertaken at post-excavation it will also be prioritised at the fieldwork stage to inform decision making and develop the strategies used on site.
- 7.3.78 Samples for radiocarbon dating will be identified from materials sampled for environmental analyses see Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation (English Heritage, 2011a); Geoarchaeology. Using earth sciences to understand the archaeological record (Historic England, 2015c); and Animal Bones and Archaeology – Recovery to archive (Baker and Worley, 2019) or from recovered artefacts. The requirements for the recovery, processing, and retention of these materials may be affected by the proposed dating programme (e.g. packaging typologically diagnostic refitting groups of ceramic sherds so that their potential for absorbed lipid analysis and dating is not compromised).
- 7.3.79 Scientific dating will also be utilised to provide spot dates to inform the excavation strategy, contribute to understanding of stratigraphic sequences, or to provide precision/resolution for statistical modelling. The APT Scientific Dating Specialist will provide advice and guidance throughout the life-cycle of the project (preparation of the SSWSIs, site investigations, and at the post-excavation assessment and analysis stages). The Historic England Regional Science Advisor the relevant Local Authority Archaeological Advisors and the National Highway Historic Environment Manager will be consulted during preparation of the SSWSI and during the project.
- 7.3.80 Scientific dating techniques will include the following:
- a. Radiocarbon (^{14}C) dating which can be used to date any carbon-based organic materials, such as wood, bone, plant remains. If remnant peat is found, reliable and high-resolution dating will be essential and multiple methods will be employed unless otherwise justified;
 - b. Luminescence dating (optically stimulated luminescence or OSL) for suitable features

- c. Archaeomagnetic dating for highly fired structures such as kilns or ovens and burnt soil
- d. A range of other absolute techniques, such as amino acid racemization, tephrochronology (dating volcanic ash from deposits)
- e. If preserved wood is present, for example, in waterlogged deposits then dendrochronology may be able to provide precise and accurate dates.

7.3.81 Scientific dating will be undertaken on the recovered samples in accordance with an explicit sampling strategy designed, in consultation with a chronological modelling specialist, to address the research questions set out in the Research Framework and the SSWSI, using simulation of the results that could be obtained from the available samples and Bayesian chronological modelling to combine these with the other available information. A sequential sampling strategy will be adopted (Bayliss, 2009: Figure 9). Multiple laboratories/techniques will be employed to ensure that robust chronologies are produced. Different strands of evidence will be combined using formal statistical modelling to produce quantitative estimates for chronologies that address the project objectives. Reporting will follow Historic England guidelines. The strategy will be devised in consultation the Historic England Regional Science Advisor, the relevant Local Authority Archaeological Advisors and the National Highway Historic Environment Manager and will be approved by the National Highway Historic Environment Manager.

Strategy for the recovery of human remains

- 7.3.82 The SSWSIs will describe a detailed strategy for the investigation, treatment, recovery and assessment/analysis of human remains (neonate/young infants, inhumations, cremations, disarticulated/charnel remains) which will be developed by the APT human remains specialist. The investigation of human remains will be undertaken in accordance with national guidelines (Historic England, 2018a; APABE, 2017; Historic England, 2013; and McKinley and Roberts, 1993), under the guidance of the APT Human Remains specialist. If scattered cremated remains are present, for example in subsoil or colluvium, it may be necessary to use a combination of methodologies and techniques (including sample sieving) to identify the source of the deposit. At the post-fieldwork stage (assessment and analysis) the Archaeological Contractor(s) will consider the application of modern scientific studies, such as DNA work and isotope analysis.
- 7.3.83 In the event of the discovery of human remains the Archaeological Contractor will notify the National Highways Historic Environment Manager and the ACoW immediately. The National Highways Historic Environment Manager will immediately notify the relevant Local Authority Archaeological Advisors. Remains will be covered and protected and left in situ in the first instance, in accordance with current good practice.
- 7.3.84 In general, excavation of human remains will not extend beyond the limits of the investigation work area; however, it may be followed under the baulk so that it may be lifted in its entirety, provided this will not result in disturbance of further burials, or extend beyond the DCO boundary.

- 7.3.85 The APT human remains specialist will be available to visit a site where human remains have been found to provide specialist advice and to ensure that the work is being carried out in accordance with procedures set out in the SSWSIs.
- 7.3.86 Where inhumation burials are encountered, it is good practice to take samples from the entire lens of soil remaining at the bottom of the grave and divide it into three sections, head, torso and feet.
- 7.3.87 If grave goods are identified and are not subject to block lifting, additional specialist samples should be taken from the areas around the grave goods.
- 7.3.88 Cremation deposits should be subject to sampling and assessment for charcoal, charred plant remains, artefacts and the recovery of human bone.
- 7.3.89 Where un-urned cremations are suspected or identified, these will be subject to 100% sampling. Where large deposits of pyre debris are identified the APT human remains specialist will be contacted to devise an appropriate strategy for excavation and sampling. The strategy will be developed at site consultation meeting(s) between the Archaeological Contractor(s), the National Highways Historic Environment Manager and the relevant Local Authority Archaeological Advisors. It may be beneficial to consider half sectioning the excavation of un-urned cremations to aid an understanding of the vertical distribution of the deposit, the deposit may then be excavated in spits.
- 7.3.90 Larger fragments of charcoal (>2cm diameter) will be individually sampled (hand recovered) as specialist samples and the location of these samples recorded on the resulting plan and section drawing; the location of specialist samples will be surveyed in.
- 7.3.91 It is good practice to block lift cremation urns to allow for X-radiography and excavation under laboratory conditions. The APT conservator or field staff experienced in lifting cremation urns will be present when lifting takes place. In the first instance, the APT conservator will be contacted for advice.
- 7.3.92 In addition to traditional osteological recording, post-excavation osteological assessment will include consideration of recently developed microscopic, biomolecular, imaging and other methods for the study of human remains and the potential of these techniques to meet the research questions relevant to the project. Where research questions of the project and the aims and objectives identified in the SSWSIs can be addressed through recently developed microscopic, biomolecular, imaging and other methods for the study of human remains, the Archaeological Contractor(s) will consult with the National Highways Historic Environment Manager, the Historic England Regional Science Advisor and the relevant Local Authority Archaeological Advisors for further advice prior to analysis being undertaken. The National Highways Historic Environment Manager will approve the proposals for scientific study at the assessment and analysis stages.

Treasure

- 7.3.93 Any artefacts which are recovered that fall within the scope of the Treasure Act 1996 and Treasure (Designation) Order 2002 will be reported to the National Highways Historic Environment Manager. The National Highways Historic Environment Manager will contact His Majesty's Coroner for the relevant area and will ensure that the Treasure regulations are enforced and that all the relevant parties are kept informed. The relevant Finds Liaison Officer for the

Portable Antiquities Scheme, relevant Local Authority Archaeological Advisors and Historic England will also be notified immediately. A list of finds that have been collected that fall under the Treasure Act and related legislation will be included in the fieldwork report.

Strip, map and sample excavation

- 7.3.94 Strip, Map and Sample Excavation (SMS) is defined in Paragraph 6.4.30 to 6.4.34 above and Table 3.1. The following general approach will apply for SMS. Sites that require investigation by SMS are identified in Table 9.1 and Table 9.2, but new areas may arise from emerging results, detailed design and unexpected discoveries.
- 7.3.95 Sites designated for SMS will be stripped with mechanical plant as set out in the SSWSIs. Topsoil, subsoil or other overburden that does not contain material relevant to the research objectives will be removed to the correct archaeological horizon under archaeological supervision. The relevant horizon will be informed by the evaluation results, the research framework, and the research aims and objectives identified in the SSWSIs. The sequencing of stripping, location of soil storage areas and arrangements for backfilling, together with other relevant logistical considerations, will be set out in a Method Statement.
- 7.3.96 Following stripping, the exposed archaeological remains will be surveyed using electronic survey-grade equipment to create a detailed digital pre-excavation plan. In accordance with the research framework and the research objectives identified in the SSWSIs, a strategy based on this plan will be implemented for hand excavation of key features to recover artefactual and scientific dating evidence. At the same time selected feature complexes would be subject to further hand excavation designed to resolve stratigraphic relationships.
- 7.3.97 The proportion of features excavated will be determined by the significance of the remains, the research framework, and the site-specific research objectives developed in the SSWSIs and in consultation with relevant APT specialists.
- 7.3.98 The following minimum sampling requirements will be used as a standard, but these may be varied to suit the research value of the remains, subject to agreement between National Highways Historic Environment Manager, the Archaeological Contractors the ACoW and the relevant Local Authority Archaeological Advisors and Historic England if required.
- a. **Linear features:** A minimum sample in length not less than 1m long, where the depositional sequence is consistent along the length. Linear features with complex variations of fill type will be sampled sufficiently to understand the sequence of deposition - a minimum of 10% along the length. If appropriate all intersections will be investigated to determine the relationships between features. All termini will be investigated.
 - b. **Discrete features:** Pits, post-holes and other isolated features will normally be half-sectioned. If large pits or deposits (over 1.5m diameter) are encountered, then the sample excavated should be sufficient to define the extent and maximum depth of the feature and to achieve the objectives of the sampling but should not be less than 25%.

- c. **Structures:** Each structure will be sampled sufficiently to define the extent form, stratigraphic complexity and depth of the component features and its associated deposits to achieve the objectives of the evaluation. All intersections will be investigated to determine the relationship(s) between the component features. The remains of all upstanding walls will be hand cleaned sufficient to understand their dimensions, extent, composition, sequence and relationships.
- d. **Special or burnt features:** These features should be the subject of 100% excavation. Such features will be identified during pre-excavation planning to enable the input and advice of appropriate archaeological specialists. Where *in situ* burning is identified no excavation shall take place until the possible recovery of samples for scientific dating has been considered.
- e. **Flint scatters:** These should be the subject of 100% excavation. Where associated with buried land surfaces, *in situ* flint scatters will require hand cleaning and will need to be spatially defined in three-dimension to determine the limits of the scatter within the area of investigation. All lithic artefacts with a Maximum Linear Dimension (MLD) of 10mm will require three-dimensional plotting prior to recovery and individually bagged and recorded as registered finds. Non-tool fragments of less than the MLD should be bagged according to an appropriate spatial recording system consistent with context.
- f. **Human remains:** refer to Paragraphs 7.3.82 to 7.3.92
- g. **Tree throws:** refer to Paragraph 7.3.60 above.
- h. **Ridge and furrow:** Ridge and furrow will only be recorded during to note its alignment. No excavation of furrows is proposed.

Archaeological trial trenching

- 7.3.99 At the Preliminary Works stage additional trial trenching will be carried out in areas along the Project where, although all evaluation necessary for the purposes of the ES was completed, detailed evaluation was not completed due to access issues, or where a more limited amount of survey work was undertaken. The purpose of the trenching will be to determine the presence/absence, extent, character, condition and significance of the remains in order to inform the detailed mitigation requirements at these locations should it be required.
- 7.3.100 The approach to be employed during this stage of additional trial trenching will be identical to that used during the archaeological evaluation stage (used to inform and confirm the ES findings), and as set out in the Scheme-wide Written Scheme of Investigation for Trial Trenching south of the River Thames in ES Appendix 6.11 (Application Document 6.3) and the Scheme-wide Written Scheme of Investigation for Trial Trenching north of the River Thames in ES Appendix 6.12 (Application Document 6.3). However, the approach shall consider specific provisions of the AMS-OWSI in respect of archaeological excavation, environmental sampling and scientific dating, where relevant.

- 7.3.101 The scope and location of additional trial trenching will be described in a SSWSI that will be prepared by the Archaeological Contractor in consultation with the National Highways Historic Environment Manager, the relevant Local Authority Archaeological Advisors and Historic England. The SSWSIs will be approved by the SoS following consultation with the relevant planning authority (through the relevant Local Authority Archaeological Advisors) and Historic England, prior to works commencing in the area to which each SSWSI applies.

Geoarchaeological and palaeoenvironmental investigations

- 7.3.102 Each area requiring geoarchaeological or palaeoenvironmental assessment should have an array of boreholes or cores, designed in a grid or transects as appropriate to ensure full evaluation across the area. This design should be undertaken by the Archaeological Contractor, who must, as detailed in Section 7.1, have a geoarchaeologist and environmental specialists as part of the project team. The borehole design must take into account the results of the evaluation excavations in ES Appendix 6.8 (Application Document 6.3). and any geotechnical boreholes in the vicinity to maximise data recovery. The methodology, design and any revised or site specific aims must be detailed in a SSWSI to be prepared by the Archaeological Contractor.
- 7.3.103 Each borehole column will be recovered using a windowless sampling rig (for example a Terrier Drilling Rig, Dando Rig or for shallower deposits a power auger) that will be provided by the Principal Contractor and under the supervision of the Archaeological Contractor. The diameter of the borehole shall be approximately 100mm and the core shall be recovered in plastic tubes (or an appropriate substitute).
- 7.3.104 The location of the borehole will be set out by the Archaeological Contractor's surveyors and shall be surveyed and levelled in three dimensions to Ordnance Survey Grid and Ordnance Datum (OD).
- 7.3.105 A suitably experienced geoarchaeologist shall be present during the preparatory ground disturbance and during rig drilling. This is to ensure that a proper record is made of the depth of deposits and to ensure that samples are collected and labelled appropriately.
- 7.3.106 The Archaeological Contractor should make allowance for the excavation of a starter pit prior to drilling to confirm that no buried services, land drains or other subsurface obstructions are present.
- 7.3.107 Made ground deposits need not be described in detail unless it is relevant to the understanding of site formation processes. The surface of each deposit/the contact the core will be exposed and the sequence of sediments from the borehole shall be described/ logged on site (character and depths of deposits). If possible, a record shall be made of the depth of any water table at the borehole location.
- 7.3.108 Upon completion of the borehole and the recovery of the core, the void left by the sampling rig shall be backfilled by the operator with a suitable material.
- 7.3.109 The core sample shall be sealed, labelled, transported as soon as possible, and stored securely and in appropriate controlled conditions either on site (temporary) or off-site at the assessment stage. It may be necessary to store the core long-term if it is likely to contribute to any future analyses.

- 7.3.110 Where warranted, areas identified for geoarchaeological assessment may be stripped to reveal archaeological features sealed by the colluvium. The requirement will be dependent upon the results of the boreholes and further focus of stripping can be achieved by controlled broad transect samples (2m+). The results of this approach will guide the requirement for removal of overlying deposits by machine, which may need to be undertaken in stages for the exposure of contemporary surfaces and features over a wide area. The hand-excavated transects should be orientated perpendicular to the course of the streams in question, so that they capture in section sedimentary processes such as colluviation and headland formation. In all cases, the requirement for work should be guided by the Archaeological Contractor's geoarchaeologist.
- 7.3.111 All work must be taken in line with Historic England guidance on Geoarchaeology and Environmental Archaeology.
- 7.3.112 A preliminary interpretation of the soil and sediment characteristics of the core will be made, including a summary of the stratigraphy that will characterise the deposit sequence and identify soil/ sediment formation processes. The description of each deposit will include sediment type, inclusions, colour, bedding and nature of contacts to overlying and underlying units. The report will also include appropriate lithological diagrams.
- 7.3.113 If suitable organic sediment is recovered from the core, samples will be taken for radiocarbon dating, to provide a dating framework for the stratigraphic sequence. The Archaeological Contractor shall make provision for submitting a justified proposal and number of samples for radiocarbon dating.
- 7.3.114 If suitable deposits exist, samples will be submitted for specialist assessment (pollen, diatom/ foraminifera) to identify the potential for past environmental reconstruction.
- 7.3.115 An interim summary assessment report will be produced shortly after completion of the fieldwork to inform the design of any subsequent archaeological mitigation.
- 7.3.116 The final geoarchaeological assessment report will illustrate the sub-surface topography and shall characterise the sediments present on the site and indicate the potential of the core sample taken for environmental reconstruction. If appropriate, it will include a fully justified and costed proposal for analysis and publication.
- 7.3.117 The geoarchaeological assessment will be placed within the context of any previous investigations and assessment work undertaken in the vicinity of each site to aid the interpretation of the deposit sequence.

Palaeolithic and Holocene intrusive fieldwork

- 7.3.118 A deposit-led staged approach to Palaeolithic fieldwork will be carried out. The information from the fieldwork will be used to update the Palaeolithic and Quaternary Deposit Model (PQDM) and further proposed fieldwork. Where deposits with Palaeolithic potential occur within 5m of the surface, a programme of trenching and test pitting will be carried out, both informed by and augmented by coring and boreholes.

- 7.3.119 Where the potential for Palaeolithic land surfaces and other significant deposits has been identified, a two-stage approach to mitigation will be implemented.
- 7.3.120 The first stage will include the excavation of test pits a minimum of 10m x 10m to the depth to which the Project has potential to impact the deposits. This will be a substantial excavation requiring protection of the walls of the trench to allow a safe working area at depth. All archaeological and palaeoenvironmental deposits will need to be excavated and recorded and a detailed sampling strategy for scientific analysis and dating developed and revised during the excavation. Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.
- 7.3.121 The second stage is an iterative development of the first stage with further works determined by the outcomes of the first stage. The second stage could include further excavation at depth, additional sampling and analysis of deposits, or a process for the sampling of bulk material and retrieval of any archaeological or palaeoenvironmental material. Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.
- 7.3.122 Inaccessible deposits of Palaeolithic potential will be investigated using coring and boreholes.
- 7.3.123 All fieldwork will be carried out in line with an overarching Palaeolithic being developed by the University of Southampton and individual SSWSIs.

Monitoring during construction

Archaeological monitoring and recording

- 7.3.124 The following general approach will apply for Archaeological Monitoring and Recording during preliminary and main works stages.
- 7.3.125 Sites that require monitoring during construction activities and investigation will be those that are identified in Table 9.1 and Table 9.2 but may also include new areas that arise as a result of emerging results, detailed design and unexpected discoveries.
- 7.3.126 Sites designated for Archaeological Monitoring and Recording will be stripped with mechanical plant as set out in the SSWSIs. The Main Works Contractor's preferred method of working will be subject to archaeological supervision and control. Topsoil, subsoil or other overburden that does not contain datasets relevant to the research objectives will be stripped by a mechanical excavator fitted with a toothless bucket to the correct archaeological horizon, under the supervision of the Archaeological Contractor. The relevant horizon will be informed by the evaluation results, the Research Framework and the research aims and objectives identified in the SSWSIs. The sequencing of stripping, together with other relevant logistical considerations will be set out in a Method Statement.
- 7.3.127 Following stripping, if archaeological remains are identified they will be surveyed using electronic survey-grade equipment to create a detailed digital pre-excavation plan. In accordance with the ARA and the aims and objectives that will be identified in each SSWSI, a strategy based on this plan will be

implemented for hand excavation of key features to recover artefactual and scientific dating evidence. At the same time selected feature complexes would be subject to further hand excavation designed to resolve stratigraphic relationships.

- 7.3.128 The Main Works Contractor will allow sufficient time for the investigation of the archaeological remains. The National Highways Historic Environment Manager and the ACoW in consultation with the relevant Local Authority Archaeological Advisors and if appropriate, Historic England, will determine the scope of work and timetable for the completion of the investigation at each site. Vehicles and other plant will not be permitted to track over areas that contain remains until archaeological investigations are complete, or until the ACoW has given permission.
- 7.3.129 The National Highways Historic Environment Manager and the ACoW in consultation with the relevant Local Authority Archaeological Advisors and if appropriate, Historic England will determine access parameters for plant. However, once the parameters have been established, access for plant will be controlled pro-actively by the Archaeological Contractor(s). In the event of genuinely different circumstances further consultation (as part of normal or additional site meetings) would be anticipated.
- 7.3.130 Modification of the works specification may be required during the investigations to enable detailed recording to take place, and to allow adequate time within the construction programme in the event of important discoveries. In this situation a revised SSWSI will be prepared by the Archaeological Contractor(s) in consultation the National Highways Historic Environment Manager and the ACoW in consultation with the relevant Local Authority Archaeological Advisors and if appropriate, Historic England, prior to works commencing in the area to which the SSWSI applies.
- 7.3.131 In the event of an unexpected discovery requiring further investigation (that is, a significant find that was not predicted as a result of the evaluation), the provisions set out above will apply. A site consultation meeting will be held which will consider the specific nature of any unexpected archaeological remains and the potential impacts of any construction activity on the unexpected archaeological remains. The outcomes of this meeting will inform any further archaeological work and the extent of any stand-off beyond 10m that may be required. The area will be fenced off, cleaned archaeologically and recording works completed, in line with a revised SSWSI prepared by the National Highways Historic Environment Manager and the ACoW in consultation with the relevant Local Authority Archaeological Advisors and if appropriate, Historic England. In accordance with Requirement 9 of the Draft Development Consent Order (Application Document 3.1), any unexpected finds must be retained in situ and reported to the relevant planning authority as soon as reasonably practicable. No construction can take place for 14 days from the date of such finds being reported unless otherwise agreed in writing by the Secretary of State. If the relevant planning authority finds that further investigation is needed, no construction shall take place within a minimum of 10 metres of the remains until further investigation and recording including details to be agreed by the Secretary of State and approved by the relevant planning authority.

8 Reporting, publication and dissemination

- 8.1.1 Following the completion of the fieldwork, all finds and samples will be processed (cleaned and marked). Each category of find or environmental/industrial material will be examined by a suitably qualified specialist so that the results can be included in the Post-Excavation Assessment Report (PEAR) to be produced at the end of the investigations.

8.2 Interim statements

- 8.2.1 Interim statements will be prepared and submitted to the National Highways Historic Environment Manager. The purpose of each interim statement is to provide a basic account of the results of the investigations at each site to inform the progress meetings. Interim statements will be prepared within a set time frame following completion of fieldwork at the relevant site. This time frame will be decided by the National Highways Historic Environment Manager prior to the commencement of the post-excavation work. The interim statement will include:
- A summary of the results
 - A draft or sketch plan of each archaeological area or site
 - A quantification of the primary archive including finds and samples
 - Identify any issues that have arisen to ensure that there is integration across the Project between sites and phases
 - A programme of work and schedule for the completion of the PEAR

8.3 Post Excavation Assessment Report (PEAR)

- 8.3.1 The Archaeological Contractor(s) will meet the set time frames in order that the post- excavation assessment, analysis, and publication phases can be programmed and resourced properly, and so that the completion date for all construction and post-excavation works can be met.
- 8.3.2 The results from several fieldwork interventions may be combined and treated as one site for the purposes of the post-excavation assessment and analysis stages. The results from earlier investigations (evaluation surveys and excavations) will also be assessed/reviewed by the Archaeological Contractor(s) where it contributes to an understanding of the site and addresses the research framework and aims and objectives of the SSWSIs. Following the completion of the post-excavation assessment, the original project objectives will be reviewed to determine the scope of any analysis and publication.
- 8.3.3 The preparation of the project archive, post-excavation assessment and subsequent analysis and publication phases will be undertaken in accordance with DMRB (LA116), the SSWSIs and Historic England guidelines (Historic England, 2015a), and other relevant archaeological standards and national guidelines. The different phases will be completed within a set time frame following completion of fieldwork, as agreed between the Archaeological Contractor and the National Highways Historic Environment Manager in consultation with relevant Local Authority Archaeological Advisors and, if relevant, Historic England.

- 8.3.4 The precise format of the reports is dependent upon the findings of the investigations, but the PEAR will contain the following:
- a. A non-technical summary
 - b. Site location
 - c. Brief archaeological, historical and project background
 - d. Methodology
 - e. Aims and objectives
 - f. Results – factual data statements (stratigraphic, artefactual, environmental, initial scientific dating results)
 - g. Statements of potential (stratigraphic, artefactual, environmental)
 - h. Statements regarding immediate and long-term storage and curation
 - i. Review of original aims and objectives
 - j. Statement of the significance of the results in their local, regional, national and international context
 - k. Archaeological Research Design (ARD) that sets out how the research framework and research aims and objectives of the SSWSIs can be addressed at the analysis stage
 - l. Post-excavation analysis method statements
 - m. Recommendations for analysis, reporting and publication (including a synopsis of the proposed contents)
 - n. Proposed resources and programming (task list linked to key personnel, time required, cost and key research questions that the task will answer or facilitate and programme cascade chart)
 - o. General and detailed plans showing the location of the investigation areas accurately positioned on an OS base with grid co-ordinates and a plan of the identified archaeological remains (to a known scale)
 - p. Detailed plans and sections/profiles, deposit models etc., to support the narrative
 - q. Detailed stratigraphic matrix for each area excavated and how the areas interlink
 - r. Photographs and illustrations, including 3D models
 - s. Bibliography
 - t. A cross-referenced index to the project archive and summary of contexts
 - u. Appendices containing specialist reports
- 8.3.5 The PEAR and Archaeological Research Design (ARD) will be submitted to the National Highways Historic Environment Manager for review and

comment. The Archaeological Contractor will address any comments that the National Highways Historic Environment Manager may have. The National Highways Historic Environment Manager will issue the revised draft report to relevant Local Authority Archaeological Advisors and Historic England for comment. In finalising the report, the Archaeological Contractor will take account of these comments.

8.3.6 The scope of the analysis and publication report will be dependent upon the assessment and future discussions to be held with the National Highways Historic Environment Manager, relevant Local Authority Archaeological Advisors and Historic England. The analysis stage will be undertaken in accordance with the ARD and will lead to the compilation of a research archive and the production of integrated report texts and illustrations for publication.

8.3.7 In accordance with the principles of Management of Research Projects in the Historic Environment (MoRPHE) (Historic England, 2006) and the Management of Archaeological Projects, 2nd Ed (MAP2) (Historic England, 1991), a staged programme of post-excavation assessment and reporting will be carried out, to commence on completion of archaeological mitigation fieldwork. The terminology used in relation to this is 'project design' and 'updated project design'. In this context, 'project' references the archaeological post-excavation project and not the Proposed Development. This 'project design' and 'updated project design' will be developed in consultation with key stakeholders (Historic England, the archaeological and historic building advisors to the Local Planning Authorities) and agreed by the relevant Local Authority Archaeological Advisors.

8.4 Conservation and assessment

8.4.1 Following (or, where suitable, during) fieldwork, the findings will be assessed against the original project design to determine the extent to which the original research aims have been met, and to identify any new research questions to be incorporated in a post-excavation project design.

8.4.2 A post-excavation assessment report will be produced, and this report will form part of the project archive. It will include a statement of the quantity and perceived quality of the data in the site archive, a statement of the archaeological potential of the data to answer the project research aims, and recommendations on the analysis and data storage and curation requirements.

8.4.3 After processing, including conservation, recording and marking, the finds assemblage from the mitigation must be assessed to give an overview of its potential to meet the research aims of the project. The value of the archaeological material for research and/or educational use beyond the terms of the project design should also be recorded. The recommendations for the extent or depth of further analysis of all, or selected components of, the finds assemblage will be given and justified at this stage and will contribute to the updated project design. The assessment will also determine the resource requirements for analysis and identify conservation needs both for analysis and long-term storage and curation. Further analysis should not proceed without the assessment.

8.4.4 Specialist assessment and site narratives would be prepared for inclusion in an updated project design. This would be prepared on completion of the specialist

assessment, providing a scope for the analysis, reporting and publication of the findings.

8.5 Analysis and reporting

- 8.5.1 The project-specific research aims would be addressed in determining the scope for further specialist analysis. This would be carried out in line with the agreed updated project design and against measurable programme milestones, to ensure a reasonable and timely programme for the final publication and public dissemination of the results.
- 8.5.2 As a minimum, reports will be produced and deposited with the relevant Historic Environment Records within a reasonable and agreed timescale from completion of fieldwork.

8.6 Archiving

- 8.6.1 All reasonable steps will be taken to obtain the agreement of the landowner to the deposition of the full project archive, and transfer of title to the relevant repository or repositories before mitigation commences.
- 8.6.2 An archiving strategy, including digital archiving will be developed prior to the preparation of any SSWSIs.
- 8.6.3 The relevant repository or repositories would be consulted before the archive is prepared regarding the specific requirements for the archive deposition and curation, and regarding any specific cost implications of deposition, including the long-term storage of material requiring special conditions, such as relative humidity and temperature
- 8.6.4 Where there is the potential for deposition in a relevant repository or repositories to be delayed, this, and any potential costs arising, should be clearly identified.
- 8.6.5 In addition to the deposition of project reports and archive with the relevant Local Authority Archaeological Advisors, an electronic record of the project details will be created through OASIS. The project record would include technical details for each technique used in the project. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service ArchSearch catalogue.

8.7 Publication

- 8.7.1 The Project is likely to provide scope for additional and more complex reporting, through for example a period or regional journal, stand-alone 'monograph' publication and/or popular publication. In addition, popular publications that include, for example, reconstruction drawings and non-technical summaries could be provided to make the results of the onsite mitigation recording more publicly accessible. A programme and strategy for the publication, and public dissemination of the results of the archaeological programme of works will be provided in the updated project design.

9 Location of heritage assets requiring archaeological mitigation

9.1.1 Archaeological mitigation is required across the Project at the locations identified on Figure 2. For the purposes of this dAMS-OWSI those areas are still shown as individual Heritage Assets. The following tables set out proposed mitigation.

- a. Table 9.1 identifies specific heritage assets South of the River Thames and describes the proposed mitigation to record those assets.
- b. Table 9.2 identifies specific heritage assets North of the River Thames and describes the proposed mitigation to record those assets.
- c. Table 9.3 identifies the historic buildings and describes the proposed mitigation to record those assets.

Table 9.1 Proposed mitigation on specific heritage assets South of the River Thames

Heritage Asset Number	Name	Mitigation Type
675	A group of pits of uncertain date, situated on the chalk on the eastern edge of Gravesend.	Strip, map and sample excavation (AMS 4.3)
677	Bronze Age/Iron Age trackway west of Thong	Strip, map and sample excavation (AMS 4.3)
703	Trackway with flanking ditches	Strip, map and sample excavation (AMS 4.3)
762	The earthworks of two possible Post-Medieval woodland banks and flanking ditches, Claylane Wood	Archaeological topographic/earthwork survey (AMS 2.1)
763	The earthwork of a possible Post-Medieval sand pit can be seen in Claylane Wood	Archaeological topographic/earthwork survey (AMS 2.1)
774	Possible Late Prehistoric or Roman Enclosure cropmark to the north of Harts Hill.	Detailed excavation (AMS 4.2)
775	The cropmarks of a probable Later Prehistoric enclosure and associated boundary ditch situated on the eastern slope of a coombe on the eastern edge of Gravesend.	Detailed excavation (AMS 4.2)
779	Cropmarks of Iron Age or Roman field boundaries	Strip, map and sample excavation (AMS 4.3)
781	The earthwork of a Post-Medieval water channel situated on the southern edge of Filborough Marshes.	Archaeological topographic/earthwork survey (AMS 2.1)
787	A Post-Medieval field boundary surviving as hedgerows, banks and a below-ground ditch	Strip, map and sample excavation (AMS 4.3)

Heritage Asset Number	Name	Mitigation Type
788	A linear ditch, possibly a later prehistoric or Roman field boundary seen as a cropmark	Strip, map and sample excavation (AMS 4.3)
793	The cropmarks of two possible Post-Medieval chalk pits, situated to the north of Harts Hill, located within an area of dense archaeological activity	Strip, map and sample excavation (AMS 4.3)
796	The cropmark of a ditch, maybe Roman in date.	Strip, map and sample excavation (AMS 4.3)
798	The cropmarks of two ditches of uncertain date, west of Muggins Lane and less than a metre wide.	Strip, map and sample excavation (AMS 4.3)
801	The remains of field boundary banks, situated on the eastern edge of Gravesend south of Chalk.	Archaeological topographic/earthwork survey (AMS 2.1)
802	The remains of three field boundary banks, situated on the eastern edge of Gravesend south of Chalk.	Archaeological topographic/earthwork survey (AMS 2.1)
803	The remains of three possible Post-Medieval field banks, situated to the south of Chalk.	Archaeological topographic/earthwork survey (AMS 2.1)
804	The cropmark of a continuation of an east-west trackway, situated to the south of Chalk.	Strip, map and sample excavation (AMS 4.3)
805	The slight earthwork remains of a Post-Medieval chalk pit. This oval chalk pit survives as a slight depression within an arable field, with archaeological activity in the vicinity.	Archaeological topographic/earthwork survey (AMS 2.1)
1302	St Thomas's Well	Detailed excavation (AMS 4.2)
1306	Medieval settlement, Henhurst Dale	Detailed excavation (AMS 4.2)
1324	Second World War RAF camps, Ashenbank Wood	Recording of above-ground heritage assets (AMS 2.0)
1331	World War Two RAF camp dispersal site for RAF Gravesend	Recording of above-ground heritage assets (AMS 2.0)
1362	Site of barrow (contracted primary; five secondary burials), cropmark	Detailed excavation (AMS 4.2)
1372	A group of rectilinear enclosures	Detailed excavation (AMS 4.2)
1396	Cropmark settlement of probable Bronze Age to Roman date including trackways, pits and ringditches	Detailed excavation (AMS 4.2)
1398	Possible enclosure fragment - cropmark	Strip, map and sample excavation (AMS 4.3)
1409	Possible field system - cropmark	Strip, map and sample excavation (AMS 4.3)

Heritage Asset Number	Name	Mitigation Type
1423	Prehistoric and undated pits and ditches	Strip, map and sample excavation (AMS 4.3)
1428	Possible boundary ditch - cropmark	Strip, map and sample excavation (AMS 4.3)
1429	Thong Second World War light anti-aircraft battery, Thong Lane, Gravesend	Recording of above-ground heritage assets (AMS 2.0)
1436	Possible boundary ditch - cropmark	Strip, map and sample excavation (AMS 4.3)
1454	AA battery, Gravesend	Recording of above-ground heritage assets (AMS 2.0)
1459	Gravesend airport (site)	No mitigation proposed
1469	Possible Bronze Age Field System, Singlewell	Strip, map and sample excavation (AMS 4.3)
1515	Earthworks, Shorne	Archaeological topographic/ earthwork survey (AMS 2.1)
1520	Iron Age ditch, Singlewell	Strip, map and sample excavation (AMS 4.3)
1524	Late Iron Age/Early Roman enclosure, east of Claylane Wood	Detailed excavation (AMS 4.2)
1547	Prehistoric and medieval features along the A2 Pepperhill to Cobham widening scheme, site J, Pond C and Bodey's Yard	Detailed excavation (AMS 4.2)
1579	Late Iron Age site, Thong Lane	Detailed excavation (AMS 4.2)
1584	Round barrow with concentric ditches	Detailed excavation (AMS 4.2)
1595	Bronze Age Barrow with biconical urn	Detailed excavation (AMS 4.2)
1596	Rectilinear Feature, Cropmark	Strip, map and sample excavation (AMS 4.3)
1598	Cropmark of former WWII site	Strip, map and sample excavation (AMS 4.3)
1600	Roman trackway and multiperiod enclosure site	Detailed excavation (AMS 4.2)
1603	Circular structure - possible hut circle (cropmark)	Detailed excavation (AMS 4.2)
1604	Circular enclosed settlement with entrance to west	Detailed excavation (AMS 4.2)
1606	Rectangular enclosed settlement - cropmark	Detailed excavation (AMS 4.2)
1607	Roman rectangular enclosure	Detailed excavation (AMS 4.2)
1608	Sub-circular Iron Age to Roman settlement enclosure	Detailed excavation (AMS 4.2)

Heritage Asset Number	Name	Mitigation Type
1609	Pits, Cropmark	Strip, map and sample excavation (AMS 4.3)
1620	Prehistoric funerary or settlement activity	Detailed excavation (AMS 4.2)
1622	Enclosures and cropmarks	Detailed excavation (AMS 4.2)
1662	Neolithic Mortuary Enclosure or Long Barrow (?), Tollgate	Preservation in situ and protective fencing (AMS 1.0)
1663	Ditched Trackway, Tollgate	Strip, map and sample excavation (AMS 4.3)
1668	Early Bronze Age pits and possible field system, Tollgate	Strip, map and sample excavation (AMS 4.3)
1680	Watling Street Roman Road	Archaeological monitoring and recording (watching brief) (AMS 5.1).
1787	Brickworks, identified through research as Brickkilns, possible two different kilns. Possibly destroyed through the A2 widening works.	Strip, map and sample excavation (AMS 4.3)
1813	Barrow of probable Bronze Age date	Detailed excavation (AMS 4.2)
1814	Sub-rectangular enclosure located 100m north of the A226, with multi-period activity from the Late Bronze Age to the Early Roman period	Detailed excavation (AMS 4.2)
1820	Possible Roman enclosure south of Thong. A rectilinear enclosure containing a number of discrete features (possibly pits). Similar in size to other possible Roman enclosures in the area.	Detailed excavation (AMS 4.2)
1821	Bronze Age to Iron Age boundary ditch.	Strip, map and sample excavation (AMS 4.3)
1822	Several cottages shown on the Cobham Tithe map of 1845 (CTR 96B) and also the OS maps of 1872 and 1897 but are not shown on mapping after this so they must have been demolished. Described as pigstie and cottage in the ward schedule	Strip, map and sample excavation (AMS 4.3)
1998	Area of built infrastructure for Cobham claypit	Recording of above-ground heritage assets (AMS 2.0)
2291	Site of multi-period Prehistoric and Roman activity	Detailed excavation (AMS 4.2)
2298	Iron Age Rectangular Enclosure	Preservation in situ and protective fencing (AMS 1.0)
2308	Sub-circular Iron Age to Roman enclosure and smaller circular enclosure	Detailed excavation (AMS 4.2)

Heritage Asset Number	Name	Mitigation Type
2461	Gadshill School Second World War air raid wardens post, Gravesend Road, Higham	Recording of above-ground heritage assets (AMS 2.0) and reinforcement or remedial works if required
2512	Cobham Coal Mine, Scalers Hill, Cobham	Strip, map and sample excavation (AMS 4.3)
3126	Roman activity, Henhurst Road	Detailed excavation (AMS 4.2)
3185	Northumberland Bottom	Detailed excavation (AMS 4.2)
3535	Medieval features along the A2 to Pepperhill to Cobham widening scheme, site J, Pond C and Bodey's Yard	Detailed excavation (AMS 4.2)
4180	Potential below-ground remains of former poultry yard in Cobham Park	Strip, map and sample excavation (AMS 4.3)
1599	Possible Anglo-Saxon burial ground, Claylane Wood	Archaeological evaluation to ascertain if asset is located within the Application Site. Additional mitigation measures (archaeological excavation and recording) would be implemented if asset is identified within the Application Site.
3530	Bronze Age Enclosure north of Shorne Ifield Road	Detailed excavation (AMS 4.2)
3640	Buried Soils of potential Late Glacial/Upper Palaeolithic date	Detailed excavation (AMS 4.2)
3643	Buried soils of Mesolithic to Neolithic horizons of activity	Detailed excavation (AMS 4.2)
3663	Area of Mesolithic/Neolithic activity	Detailed excavation (AMS 4.2)
3667	Neolithic pit and flint	Strip, map and sample excavation (AMS 4.3)
3641	Neolithic activity, pit containing large flint assemblage and pottery	Detailed excavation (AMS 4.2)
3650	Multiperiod settlement activity west of Thong	Detailed excavation (AMS 4.2)
3644	Bronze Age pit- possible waterhole.	Strip, map and sample excavation (AMS 4.3)
3655	Romano-British cremation burial, isolated with possible association to former settlement 1597.	Detailed excavation (AMS 4.2)
3658	Medieval quarrying	Archaeological topographic/ earthwork survey (AMS 2.1)
3642	Early Prehistoric flint assemblage within quarry or sink hole	Detailed excavation (AMS 4.2)

Heritage Asset Number	Name	Mitigation Type
3767	Colluvium deposits containing Palaeolithic struck flints possibly associated with a concentration of activity on higher ground of the dry valley located south of the A226.	Detailed excavation (AMS 4.2)
3737	Mesolithic flint microlith identified in a ditch feature.	Strip, map and sample excavation (AMS 4.3)
3772	Deeply stratified colluvium dating from Mesolithic onwards	Detailed excavation (AMS 4.2)
3782	Neolithic, Bronze Age and potentially associated undated activity. Pits, ditches, flint and foundation/surface of rammed chalk and flint	Detailed excavation (AMS 4.2)
3773	Neolithic and Bronze Age cremations and burnt mound	Detailed excavation (AMS 4.2)
3793	Multi-period Bronze Age, Iron Age and Roman activity	Detailed excavation (AMS 4.2)
3770	Isolated Bronze Age pit	Strip, map and sample excavation (AMS 4.3)
3786	Large Late Bronze Age to Middle Iron Age boundary ditch	Strip, map and sample excavation (AMS 4.3)
3802	Probable Middle Bronze Age cremation cemetery	Detailed excavation (AMS 4.2)
3742	Bronze to Iron Age settlement complex	Detailed excavation (AMS 4.2)
3743	Bronze Age to Iron Age ditch	Strip, map and sample excavation (AMS 4.3)
3741	Bronze Age to Iron Age trackway and undated pits and ditches	Strip, map and sample excavation (AMS 4.3)
3786	Large Late Bronze Age to Middle Iron Age boundary ditch	Strip, map and sample excavation (AMS 4.3)
3752	Romano-British ditch, possible agricultural enclosure	Detailed excavation (AMS 4.2)
3805	Area of dispersed undated, Prehistoric and Roman ditches and pits. Roman metalled trackway/holloway	Strip, map and sample excavation (AMS 4.3)
3756	Medieval to Post-Medieval field boundary ditches	Strip, map and sample excavation (AMS 4.3)
4415	Large but shallow Late Bronze Age or Early Iron Age pit	Strip, map and sample excavation (AMS 4.3)
3745	Undated cremations, cenotaph cremations, pits and ditches	Detailed excavation (AMS 4.2)

Heritage Asset Number	Name	Mitigation Type
3804	Partial Neonatal Skeleton of unknown date	Strip, map and sample excavation (AMS 4.3)
3796	Undated pits and postholes	Strip, map and sample excavation (AMS 4.3)
4619	Chalk Parish Boundary	Strip, map and sample excavation (AMS 4.3)
3751	Roman enclosure	Detailed excavation (AMS 4.2)
3740	Multi-period settlement activity	Detailed excavation (AMS 4.2)
3749	Iron Age granary, pits and undated posthole	Detailed excavation (AMS 4.2)
4425	Undated ditches, pit with burnt animal remains, pit or ditch terminus	Detailed excavation (AMS 4.2)
3773	Late Neolithic to Early Bronze Age burnt mound and Bronze Age cremation	Detailed excavation (AMS 4.2)
4426	Long undated ditch on a NNE-SSW alignment	Strip, map and sample excavation (AMS 4.3)
798	ATT WSI no. T, HEA/NMP 1551441	Strip, map and sample excavation (AMS 4.3)
3774	Possible Burnt Mound	Detailed excavation (AMS 4.2)
4427	Possible site of Roman building	Detailed excavation (AMS 4.2)
3806	Undated pits and ditch	Strip, map and sample excavation (AMS 4.3)
4428	Cropmark of a round barrow approx. 26m in diameter, WSI area no. T	Detailed excavation (AMS 4.2)
4429	Undated pits and ditches, one Bronze/Iron Age ditch	Strip, map and sample excavation (AMS 4.3)
4430	Possible ring ditch 10m in diameter	Detailed excavation (AMS 4.2)
3798	Area of dispersed undated ditches, pits and postholes north of the A226	Strip, map and sample excavation (AMS 4.3)
3582	Pit and ditches of Middle Bronze Age to Iron Age date	Strip, map and sample excavation (AMS 4.3)
3584	Medieval activity south of Higham Road suggesting nearby settlement	Strip, map and sample excavation (AMS 4.3)
4553	Pilgrim's Way/North Downs Way	Strip, map and sample excavation (AMS 4.3)
4595	Multiple phases of Prehistoric activity associated with buried land surfaces within colluvial layers 4594	Detailed excavation (AMS 4.2)
4596	Possible trackway/Holloway	Strip, map and sample excavation (AMS 4.3)

Heritage Asset Number	Name	Mitigation Type
4558	Probable Late Iron Age to Roman cremation cemetery	Detailed excavation (AMS 4.2)
4610	Below-ground remains of a holloway with metalled sections and flanking ditches	Strip, map and sample excavation (AMS 4.3)
4608	Cropmarks of a possible trackway	Strip, map and sample excavation (AMS 4.3)
4609	Cropmarks of a short section of a possible trackway	Strip, map and sample excavation (AMS 4.3)
4612	Series of linear cropmarks on different alignments	Strip, map and sample excavation (AMS 4.3)
1474	Possible Bronze Age barrow, Randall Wood, Shorne	Detailed excavation (AMS 4.2)
1557	Site of 6 Nissan Huts, located on land off Woodlands Lane, Shorne, Gravesham	Archaeological excavation and recording
1558	V1 bomb site off Woodlands Lane, Shorne, Gravesham	No mitigation proposed
4620	Chalk Parish Boundary	Strip, map and sample excavation (AMS 4.3)
4745	Great Culand, former Medieval to Modern manor and farmstead	Detailed excavation (AMS 4.2)
1577	Site of 6 Nissen Huts, located on land off Woodlands Lane, Shorne, Gravesham	Recording of above-ground heritage assets (AMS 2.0)
1578	V1 bomb site off Woodlands Lane, Shorne, Gravesham	No mitigation proposed
4123	Post-Medieval chalk pit	Archaeological topographic/ earthwork survey (AMS 2.1)

Table 9.2 Proposed mitigation on specific heritage assets North of the River Thames

Heritage Asset Number	Name	Mitigation Type
7	Orsett Causewayed Enclosure	Detailed excavation (AMS 4.2)
29	Medieval site at Grove Barns, South Ockendon	Detailed excavation (AMS 4.2)
30	Post Medieval site at Grove Barns, South Ockendon	Detailed excavation (AMS 4.2)
91	Relict sea-wall, East Tilbury saltings	Archaeological excavation and recording
97	Signpost at Baker Street, Orsett	Asset to be fenced to prevent accidental impact, or if this not possible to be removed during construction and

Heritage Asset Number	Name	Mitigation Type
		replaced in same location or as close as possible on completion of works.
104	Land at East Tilbury and Linford Area of Prehistoric ritual landscape and Roman field boundaries	Archaeological excavation and recording
109	Green Lane	Archaeological excavation and recording
118	Mar Dyke	Archaeological excavation and recording
117	Cropmarks of a possible round barrow at Redcrofts Farm	Archaeological excavation and recording
144	Mucking Marsh	Archaeological excavation and recording
161	Barvilles Solar Farm, East Tilbury, Thurrock	Archaeological excavation and recording
173	M25 - Ockendon Cutting Palaeolithic watching brief - M25026.11	Archaeological excavation and recording
184	Near Red Crofts Farm	Archaeological excavation and recording
187	North of South Ockendon	Archaeological excavation and recording
189	West of Redcrofts Farm	Archaeological excavation and recording
194	Orsett-Baker Street	Archaeological excavation and recording
195	Orsett-Baker Street	Archaeological excavation and recording
196	Orsett-Baker Street	Archaeological excavation and recording
197	Orsett-Baker Street	Archaeological excavation and recording
207	Orsett-Causewayed Enclosure	Archaeological excavation and recording. Tallest features within Brentwood Road compound to be located in southern part of compound.
210	Orsett-Causewayed Enclosure	Archaeological excavation and recording. Tallest features within Brentwood Road compound to be located in southern part of compound.
211	Orsett-Causewayed Enclosure	Archaeological excavation and recording
212	Orsett-Causewayed Enclosure (features in the vicinity of) including (2570)	Archaeological excavation and recording
213	Orsett-Causewayed Enclosure (features in the vicinity of) including (3574)	Archaeological excavation and recording
219	Nevilles Farm	Archaeological excavation and recording
220	Orsett-Barrington's Farm, Loft's Farm	Archaeological excavation and recording
229	Fen Lane, North-west of Orsett. Possible medieval moat	Archaeological Excavation and Recording

Heritage Asset Number	Name	Mitigation Type
231	A series of heavily truncated ditches and small number of pits and postholes probably representing Prehistoric field systems and settlement-periphery activity, West of Nevilles Farm	Archaeological excavation and recording
236	Orsett-Barrington's Farm-Orsett Cock, trial trenching of fire station	Archaeological excavation and recording
239	Orsett-Orsett Cock	Archaeological excavation and recording
240	Orsett-Orsett Cock	Archaeological excavation and recording
186	South of Hall Farm	Archaeological excavation and recording
245	Neolithic, Bronze Age, Iron Age, Roman features near Heath Place	Archaeological excavation and recording
246	North East edge of Grays including	Archaeological excavation and recording
247	Multi-period settlement, industrial and funerary activity at Orsett-Grey Goose Farm	Archaeological excavation and recording
257	North of Heath Place. Trenching provided a Bronze Age to Roman date.	Archaeological excavation and recording
262	West of Whitecrofts Farm including (3565) and (3566)	Archaeological excavation and recording
267	Cropmarks of a moat	Archaeological excavation and recording
288	Alan Williams Turret, Love Lane/Princess Margaret Road, East Tilbury	Archaeological/historic building recording of surviving remains, if physical impact to occur.
312	Spigot Mortar Base, Top of Gun Hill, West Tilbury	Archaeological/historic building recording of surviving remains, if physical impact to occur.
325	N of Rose Cottage, Chadwell St Mary	Archaeological excavation and recording
342	Prehistoric funerary activity NW of High House	Archaeological excavation and recording
344	Cropmarks N of High House	Archaeological excavation and recording
355	Cropmarks SE of Poplars Farm	Archaeological excavation and recording
356	Cropmarks W of Field House Farm, Middle Bronze Age to Middle Iron Age occupation	Archaeological excavation and recording.
357	Cropmarks W of Nevilles Farm	Archaeological excavation and recording
358	Cropmarks S of Orsett Primary School	Archaeological excavation and recording
360	Cropmarks SE of Grey Goose Farm	Archaeological excavation and recording
361	Cropmark SE of Redcrofts Farm	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
365	Linford - Cremation Cemetery (H-CHF93)	Archaeological excavation and recording
379	Horndon to Barking Gas Pipeline - Site 4	Archaeological excavation and recording
410	West Tilbury - Low Street (cremation urns found in a gravel pit)	Archaeological excavation and recording
412	East Tilbury Foreshore	Archaeological excavation and recording
446	East Tilbury - Muckingford Lane	Archaeological excavation and recording
449	Cropmarks at West Tilbury- High House. Originally a large HER polygon called "Enclosures" has now been reduced following LTC trial trench evaluation	Archaeological excavation and recording
450	Cropmark complex East of Mill House, Chadwell St Mary	Archaeological excavation and recording
452	East Tilbury	Archaeological excavation and recording
459	Cropmarks of pits and ditches at West Tilbury - Mill House Farm	Archaeological excavation and recording
477	West Tilbury - Gun Hill, Cropmarks east of Turnpike Lane	Archaeological excavation and recording
479	North of Holford Farm	Archaeological excavation and recording
482	Orsett	Archaeological excavation and recording
487	Mill House	Archaeological excavation and recording
493	Linford	Archaeological excavation and recording
496	A multi-period site with settlement and salt-making industry with activity from the Neolithic to the Early Medieval Period, with subsequent Medieval agricultural activity and an undated unurned cremation	Archaeological excavation and recording
520	Orsett-Collingwood Farm	Archaeological excavation and recording
586	Moor Lane, Queens Gardens, Cranham [cropmark]	Archaeological excavation and recording
594	Ockendon Road, North Ockendon, Havering [possible early medieval cropmarks]	Archaeological excavation and recording
595	Cropmarks of a rectilinear enclosure, pits and ringditches	Archaeological excavation and recording
598	Cropmarks of a trackway of possible Medieval to Post-Medieval date	Archaeological excavation and recording
605	Ockendon Road, North Ockendon, Havering [possible prehistoric cropmarks]	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
611	Ockendon Road, North Ockendon, Havering [undated cropmarks]	Archaeological excavation and recording
633	St Marys Hospital and Chapel	Archaeological excavation and recording
637	Possible Neolithic burial	Archaeological excavation and recording
690	Low Street Station	Archaeological excavation and recording
715	Feature	Archaeological excavation and recording
717	Feature	Archaeological excavation and recording
741	Remains of a Second World War or later radar mast near Coalhouse Fort. Precise location not known.	Archaeological excavation and recording
1789	Cropmarks of a trackway which is probably a continuation of the Iron Age track/funnel associated the enclosure to the south-east (Site 22). There are also a large group of small pits of an unknown date	Archaeological excavation and recording
1790	Cropmarks of former field boundaries forming a field system, these features are visible on the 1st edition OS mapping of the 1880s but may have earlier origins	Archaeological excavation and recording
1798	Cropmarks of a former field boundary visible on the 1st edition OS mapping of the 1880s. No sign of the potential red hills identified from geophysics.	Archaeological excavation and recording
1802	Cropmarks of a possible ring-ditch, that may represent a ploughed-level Bronze Age round barrow. The ring-ditch is not clearly visible on several photographs and may only be a geological mark.	Archaeological excavation and recording
1804	Cropmarks of a possible ring ditch were visible on a single aerial photograph, however the mark is not thought to be archaeological in origin (possible agricultural mark) and was therefore not mapped.	Archaeological excavation and recording
1805	Cropmarks of former field boundaries of a possible late medieval date and two rectangular enclosures.	Archaeological excavation and recording
1808	Seaborough Hall was a medieval manor house that was also used in the post-medieval period. It was demolished in the early 20th century and all that remains is a wall adjacent to Brentwood Road	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
1810	Green Lane shown on the c.1841 tithe map of North Ockendon	Archaeological excavation and recording
1811	Brick Kiln Field shown on map of the North Ockendon Hall Farm estate dating to 1775	Archaeological excavation and recording
1831	Very shallow linear depression c. 65m east of SM1, possible archaeological feature but could be route of pipe/service.	Archaeological excavation and recording
1832	A pair of circular stone sunken features.	Archaeological excavation and recording
1833	Drainage from Coalhouse Fort (SM14) moat, direction of flow (from fort) SW, N, W and S. Precise route of watercourse along northern section unclear. Info provided by Coalhouse Ranger 04.07.2018.	GPS survey of location
1864	Site of former farmstead of Botney	Archaeological excavation and recording
1867	Uneven ground with possible former field boundary banks. Possible former paddocks now replaced. Banks form rough rectangular shape with possible internal squares. Small trees in field may have associations as remaining extant features if boundaries.	Archaeological excavation and recording
2057	Site of Hobletts Farm, Orsett Fen (potential below-ground archaeological remains, for extant farmhouse see 4164)	Archaeological excavation and recording
2062	Botney Farm, South Ockendon	Archaeological excavation and recording
2078	Cropmarks S of Hill House, Baker Street	Archaeological excavation and recording
3553	Bronze Age to Iron Age enclosed settlement	Archaeological excavation and recording
3554	Bronze Age or Iron Age pit and undated ditches	Archaeological excavation and recording
3559	Medieval quarry pits containing pottery	Archaeological excavation and recording
3567	Late Neolithic to Early Bronze Age pit or ditch terminus.	Archaeological excavation and recording
3568	Isolated ditch dated to the Late Bronze Age to early Iron Age	Archaeological excavation and recording. Preservation in situ of remains located outside Order Limits, where asset was identified.
3572	Bronze Age features	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3573	Ditches producing possible Roman pottery	Archaeological excavation and recording
3573	Iron Age to Roman ditch- continuation of trackway.	Archaeological excavation and recording
3575	Continuous roughly linear feature containing much burnt material, may represent a boundary marker	Archaeological excavation and recording
3576	Two linear ditches which match an alignment of two perpendicular linear cropmarks	Archaeological excavation and recording
3577	Remains of brick walls and a possible beam slot relating to the now demolished Seaborough Hall	Archaeological excavation and recording
3588	Undated Trackway	Archaeological excavation and recording
3589	Potential Medieval site	Archaeological excavation and recording
3599	Findspot of a Late Mesolithic backed flint bladelet redeposited in colluvium along with Bronze Age and Iron Age pottery	Archaeological excavation and recording
3615	Romano-British industrial or agricultural feature including short parallel ditches similar to that found within asset 247	Archaeological excavation and recording
3617	Roman ditch and an undated ditch and pit	Archaeological excavation and recording
3623	A series of heavily truncated ditches and small number of pits and postholes probably representing Prehistoric field systems and settlement-periphery activity	Archaeological excavation and recording
3624	A ringditch with a Bronze Age or Early Iron Age pottery vessel within the ditch, West of Nevilles Farm	Archaeological excavation and recording
3625	Late Medieval to Post-Medieval field system	Archaeological excavation and recording
3627	Concentration of Prehistoric activity	Archaeological excavation and recording
3668	Assemblage of redeposited Early Neolithic flint and Bronze Age pottery	Archaeological excavation and recording
3669	Area of dispersed undated, Early Neolithic and Bronze Age pits and ditches, south of Muckingford Road	Archaeological excavation and recording
3670	Rectilinear enclosure of possible Early Medieval date south of Muckingford Road	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3671	Round barrow and possible associated flat cemetery south of Muckingford Road	Archaeological excavation and recording
3672	Isolated and tentatively dated Roman ditch	Archaeological excavation and recording
3673	Medieval pit and undated ditch	Archaeological excavation and recording
3674	Early Post-Medieval pits, ditches and possible quarry pits backfilled with waste material	Archaeological excavation and recording
3675	Middle to Late Bronze Age occupation site with pits, ditches, pottery and fired hearth clay	Archaeological excavation and recording
3676	Dispersed Middle Bronze Age and undated pits and ditches	Archaeological excavation and recording
3677	Area of Bronze Age settlement activity	Archaeological excavation and recording
3678	Ditch of late Prehistoric date	Archaeological excavation and recording
3679	Pit of late Prehistoric date	Archaeological excavation and recording
3696	Prehistoric area of activity comprising pits and ditches	Archaeological excavation and recording
3699	Late post-medieval field boundaries	Archaeological excavation and recording
3703	Findspot of Mesolithic or Early Neolithic flints found residually within an undated ditch	Archaeological excavation and recording
3704	Two undated ditches and pit or tree throw containing sherds of Late Bronze Age or Iron Age pottery	Archaeological excavation and recording
3712	Possible Roman agricultural activity with residual Middle Bronze Age to Iron Age potsherd and unstratified Early to Middle Neolithic potsherd	Archaeological excavation and recording
3713	Middle Bronze Age and undated possible ritual and/or domestic activity	Archaeological excavation and recording
3721	Medieval and Post-Medieval settlement periphery activity - pits and ditches with pottery of both periods and butchered animal bones	Archaeological excavation and recording
3722	Undated, Neolithic, Bronze Age, Iron Age, Roman and Early Medieval activity including ditches, pits, an undated pyre material deposition in a tree throw and Early Medieval pottery in a tree throw. Possible ritual activity.	Archaeological excavation and recording
3723	Spread of Neolithic pottery including pit.	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3726	Features dating to the late Bronze Age to Iron Age	Archaeological excavation and recording
3732	Ditch of probable Roman enclosure	Archaeological excavation and recording
3733	Concentration of activity predominately of Prehistoric date but with some Anglo-Saxon to Medieval.	Archaeological excavation and recording
3734	Pit containing 1kg of 13th to 14th century pottery.	Archaeological excavation and recording
3758	Undated ditch feature	Archaeological excavation and recording
3759	Medieval to Early Medieval pit.	Archaeological excavation and recording
3760	Undated ditch feature	Archaeological excavation and recording
3765	Ditch of probable medieval enclosure	Archaeological excavation and recording
3829	Later Medieval enclosures including settlement and industrial activity	Archaeological excavation and recording
3832	Early Bronze Age to Early Iron Age occupation and craftworking	Archaeological excavation and recording; protective fencing during construction
3833	Pit containing Middle Bronze Age pottery	Archaeological excavation and recording
3835	Later Prehistoric occupation site, domestic and funerary activity	Archaeological excavation and recording
3836	Bronze Age to Iron Age settlement and ritual activity bisected by railway	Archaeological excavation and recording
3837	Prehistoric occupation site	Archaeological excavation and recording
3840	Site of Middle to Late Roman activity (200 - 400AD)	Archaeological excavation and recording
3841	Late Bronze Age/Iron Age/Roman occupation site	Archaeological excavation and recording
3845	Possible later Prehistoric cultivation ditches	Archaeological excavation and recording
3846	Medieval and undated ditches with evidence for nearby arable farming	Archaeological excavation and recording
3847	Remains of possible structure and Late Prehistoric/Roman/Medieval activity	Archaeological excavation and recording
3848	Early Medieval to Post-Medieval activity including Tudor kiln and pond	Archaeological excavation and recording
3874	Late Bronze Age/Early Iron Age activity	Archaeological excavation and recording
3878	Location of Mesolithic worked flint recovered from infill of periglacial feature	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3879	Location of Mesolithic worked flint recovered from infill of Late Iron Age/Roman cultivation ditch	Archaeological excavation and recording
3886	Ditches Late Bronze Age - Early Iron Age possible related to trackway	Archaeological excavation and recording
3887	Area of possible Late Bronze Age- Early Iron Age activity two pits containing pottery but with intrusive CBM	Archaeological excavation and recording
3891	Possible Roman field/enclosure system	Archaeological excavation and recording
3892	Possible Roman field/enclosure system	Archaeological excavation and recording
3897	Late Iron Age/Roman agricultural site	Archaeological excavation and recording
3902	Possible Medieval farmstead	Archaeological excavation and recording
3936	Late Bronze Age unurned cremation (possible cemetery)	Archaeological excavation and recording
3940	Iron Age timber structure possible footbridge	Archaeological excavation and recording
3949	Possible Roman cultivation system	Archaeological excavation and recording
3952	Mesolithic/Neolithic flint assemblage	Archaeological excavation and recording
4172	Site of well	Archaeological excavation and recording
4177	Sea wall	Archaeological excavation and recording
4194	Site of cisterns, well and engine house associated with railway	Archaeological excavation and recording
4198	Site of railway sidings and structures at Gravel Pit Farm	Archaeological excavation and recording
4203	Site of infilled pond	Archaeological excavation and recording
4204	Site of infilled pond	Archaeological excavation and recording
4620	Two flakes of struck flint and one piece of burnt flint	Archaeological excavation and recording
4621	Findspot of redeposited piece of broken blade-like flake from a bullhead flint in good condition, found within later deposits	Archaeological excavation and recording
4622	Series of parallel unmapped ditches containing a fragment of peg tile (1480 - 1800) and a brick (1450 - 1700 but generally Tudor)	Archaeological excavation and recording
4623	A flint surface or track beneath a buried soil deposit of possible Early Iron Age date	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
4624	Undated parallel north-south ditches (potentially a trackway) and a potentially related undated ditch to north	Archaeological excavation and recording
4625	Part of a possible Bronze Age field system	Archaeological excavation and recording
4626	Early Prehistoric to Late Prehistoric activity	Archaeological excavation and recording
4627	Residual findspot of a Mesolithic microlith in a Prehistoric to Roman ditch	Archaeological excavation and recording
4759	Late post-medieval field boundaries	Archaeological excavation and recording
4761	Cropmarks of a small partial rectilinear feature	Archaeological excavation and recording
4765	Post Medieval ditches	Archaeological excavation and recording
4766	Ditches and quarry of probable Post Medieval date	Archaeological excavation and recording
4767	Dispersed pits, ditches and gullies, some likely Modern but some potentially of Prehistoric date, no dating evidence. Likely settlement-periphery activity	Archaeological excavation and recording
3598	Neolithic, Bronze Age, Iron Age and Undated settlement activity	Archaeological excavation and recording
4768	Middle or Late Bronze Age dispersed pits, ditches and a posthole	Archaeological excavation and recording
4769	Pits, ditch terminus and tree throws	Archaeological excavation and recording
3619	Late Neolithic to Bronze Age funerary and possible ritual activity	Archaeological excavation and recording
3601	Iron Age to Roman possible industrial activity	Archaeological excavation and recording
4770	Findspot of Late Mesolithic rod microlith, residual within a later ditch	Archaeological excavation and recording
3602	Pit with flint-tempered late Bronze Age to Iron Age pottery, charcoal and charred wheat grain and an undated ditch	Archaeological excavation and recording
3914	Pits containing later Neolithic worked flint and middle Bronze Age pottery	Archaeological excavation and recording
3918	Early or Middle Iron Age settlement activity, including some undated features that are likely to be related	Archaeological excavation and recording
3920	Ditches of Roman date potentially forming enclosures	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3911	Find spot of Early Neolithic leaf shaped arrowhead	Archaeological excavation and recording
3925	Bone-lined drains	Archaeological excavation and recording
3908	Findspots of Mesolithic flints	Archaeological excavation and recording
3926	Poorly preserved crouched inhumation burial associated with small amount of Neolithic/later prehistoric worked flint and pottery	Archaeological excavation and recording
3904	Findspot of a late Upper Palaeolithic long blade	Archaeological excavation and recording
3907	Tree throw holes and pits containing Mesolithic, Neolithic and Early Bronze Age flint and Neolithic and later prehistoric pottery	Archaeological excavation and recording
3959	Tree throw containing later prehistoric flint and pit containing charcoal	Archaeological excavation and recording
3906	A small scatter of struck flints of Mesolithic character on a buried land surface	Archaeological excavation and recording
3903	A late Upper Palaeolithic long blade was recorded in Trench 107 along with several other unusually large blades which may also date from this period	Archaeological excavation and recording
3905	A very substantial assemblage of Mesolithic flint from buried soils, later pottery or other finds also present	Archaeological excavation and recording
3924	Later medieval activity comprising a large ditch and multiple pits containing 11th-13th century pottery	Archaeological excavation and recording
3922	Low-intensity multi-period activity including Undated pits and ditches, a pit with Early Medieval pottery, pit with Roman pottery and possible Bronze Age or Iron Age craftworking and Post-Medieval track with Medieval pottery in the fill	Archaeological excavation and recording
3917	Bronze Age or Iron Age pit	Archaeological excavation and recording
3957	Undated ditches and ditch terminus or pit, Prehistoric buried soil horizons and occasional struck flint (no defined scatters)	Archaeological excavation and recording
3916	Bronze Age and Undated salt-making and other industrial activities	Archaeological excavation and recording

Heritage Asset Number	Name	Mitigation Type
3923	Three perpendicular roadside ditches containing Early Medieval to Post-Medieval pottery and roof tiles	Archaeological excavation and recording
3921	Heavily truncated Roman enclosure and outlying Prehistoric pits and ditches	Archaeological Excavation and Recording (REAC Ref. CH001; AMS-OWSI No. 4)
4771	Several Undated and Prehistoric features including a pond, ditches forming a field system or enclosure and a pit	Archaeological Excavation and Recording (REAC Ref. CH001; AMS-OWSI No. 4)
4772	Medieval perpendicular ditches and a pit	Archaeological Excavation and Recording (REAC Ref. CH001; AMS-OWSI No. 4)
4773	Ditch terminus	Archaeological Excavation and Recording (REAC Ref. CH001; AMS-OWSI No. 4)
4774	Pit containing CBM fragment	Archaeological Excavation and Recording (REAC Ref. CH001; AMS-OWSI No. 4)

Table 9.3 Proposed mitigation on standing heritage assets

Heritage Asset Number	Name	Mitigation Type
LB58	Thatched Cottage	Level 4 Historic Building Recording
LB89	1 and 2 Grays Corner Cottage	Level 4 Historic Building Recording
LB96	Murrells Cottages	Level 4 Historic Building Recording
LB57	Baker Street Windmill	Level 3 Historic Building Recording, with a particular emphasis on setting
LB37	Whitcroft's Farmhouse	Level 3 Historic Building Recording, with a particular emphasis on setting
4153	Estate House, Ockendon Road	Level 4 Historic Building Recording
4154	1 Bridge Cottages, Ockendon Road	Level 4 Historic Building Recording
4155	2 Bridge Cottages, Ockendon Road	Level 4 Historic Building Recording
4156	3 Bridge Cottages, Ockendon Road	Level 4 Historic Building Recording
4157	4 Bridge Cottages, Ockendon Road	Level 4 Historic Building Recording

Heritage Asset Number	Name	Mitigation Type
4159	1 and 2 Whitfields Cottages	Level 3 Historic Building Recording
4775	Larwood Cottage, Ockendon Road, Ockendon Road	Level 4 Historic Building Recording
4776	The Rosery, Ockendon Road	Level 4 Historic Building Recording
n/a	1 and 2 Cherry Orchard Cottages, Ockendon Road	Level 4 Historic Building Recording
1561	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4401	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4402	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4403	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4597	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4598	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4599	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting
4600	WW1 Homes for Heroes scheme houses, Thong Lane, Shorne, Gravesham	Level 3 Historic Building Recording, with a particular emphasis on setting

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Glossary

Term	Abbreviation	Explanation
A122		The new A122 trunk road to be constructed as part of the Lower Thames Crossing project, including links, as defined in Part 2, Schedule 5 (Classification of Roads) in the draft Development Consent Order (Application Document 3.1)
A122 Lower Thames Crossing	Project	A proposed new crossing of the Thames Estuary linking the county of Kent with the county of Essex, at or east of the existing Dartford Crossing.
A122 Lower Thames Crossing/M25 junction		New junction with north-facing slip roads on the M25 between M25 junctions 29 and 30, near North Ockendon.
A13/A1089/A122 Lower Thames Crossing junction		Alteration of the existing junction between the A13 and the A1089, and construction of a new junction between the A122 Lower Thames Crossing and the A13 and A1089, comprising the following link roads: <ul style="list-style-type: none"> • Improved A13 westbound to A122 Lower Thames Crossing southbound • Improved A13 westbound to A122 Lower Thames Crossing northbound • Improved A13 westbound to A1089 southbound • A122 Lower Thames Crossing southbound to improved A13 eastbound and Orsett Cock roundabout • A122 Lower Thames Crossing northbound to improved A13 eastbound and Orsett Cock roundabout • Orsett Cock roundabout to the improved A13 westbound • Improved A13 eastbound to Orsett Cock roundabout • Improved A1089 northbound to A122 Lower Thames Crossing northbound • Improved A1089 northbound to A122 Lower Thames Crossing southbound
A2		A major road in south-east England, connecting London with the English Channel port of Dover in Kent.
Archaeological Mitigation Strategy	AMS	A document that outlines the Principles Aims and Objectives of heritage mitigation across the Project
Application Document		In the context of the Project, a document submitted to the Planning Inspectorate as part of the application for development consent.
Archaeological Trial Trenching	ATT	A programme of archaeological fieldwork conducted across the Project to identify previously unknown buried archaeological remains and determine their levels of preservation and value
Construction		Activity on and/or offsite required to implement the Project. The construction phase is considered to commence with the first activity on site (e.g. creation of site access), and ends with demobilisation.

Term	Abbreviation	Explanation
Design Manual for Roads and Bridges	DMRB	A comprehensive manual containing requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (National Highways, Transport Scotland, the Welsh Government or the Department for Regional Development (Northern Ireland)) is highway authority. For the A122 Lower Thames Crossing the Overseeing Organisation is National Highways.
Chartered Institute for Archaeologists	CifA	The professional body for archaeologists within the UK
Development Consent Order	DCO	Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008.
Development Consent Order application	DCO application	The Project Application Documents, collectively known as the 'DCO application'.
East of England Research Framework	EERF	The research framework setting out an agenda for heritage work in the East of England
Environmental Statement	ES	A document produced to support an application for development consent that is subject to Environmental Impact Assessment (EIA), which sets out the likely impacts on the environment arising from the proposed development.
Greater Thames Estuary Historic Environment Research Framework	GTEHERF	The research framework setting out an agenda for heritage work in the Greater Thames Estuary
Highways England		Former name of National Highways.
M2 junction 1		The M2 will be widened from three lanes to four in both directions through M2 junction 1.
M2/A2/Lower Thames Crossing junction		New junction proposed as part of the Project to the east of Gravesend between the A2 and the new A122 Lower Thames Crossing with connections to the M2.
M25 junction 29		Improvement works to M25 junction 29 and to the M25 north of junction 29. The M25 through junction 29 will be widened from three lanes to four in both directions with hard shoulders.
Management of Research Projects in the Historic Environment	MoRPHE	Historic England's project management guidance
National Highways		A UK government-owned company with responsibility for managing the motorways and major roads in England. Formerly known as Highways England.

Term	Abbreviation	Explanation
National Planning Policy Framework	NPPF	A framework published in March 2012 by the UK's Department of Communities and Local Government, consolidating previously issued documents called Planning Policy Statements (PPS) and Planning Practice Guidance Notes (PPG) for use in England. The NPPF was updated in February 2019 and again in July 2021 by the Ministry of Housing, Communities and Local Government.
National Policy Statement	NPS	Set out UK government policy on different types of national infrastructure development, including energy, transport, water and waste. There are 12 NPS, providing the framework within which Examining Authorities make their recommendations to the Secretary of State.
National Policy Statement for National Networks	NPSNN	Sets out the need for, and Government's policies to deliver, development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. It provides planning guidance for promoters of NSIPs on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.
Nationally Significant Infrastructure Project	NSIP	Major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, major road projects etc that require a development consent under the Planning Act 2008.
North Portal		The North Portal (northern tunnel entrance) would be located to the west of East Tilbury. Emergency access and vehicle turn-around facilities would be provided at the tunnel portal. The tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations.
Operation		Describes the operational phase of a completed development and is considered to commence at the end of the construction phase, after demobilisation.
Order Limits		The outermost extent of the Project, indicated on the Plans by a red line. This is the Limit of Land to be Acquired or Used (LLAU) by the Project. This is the area in which the DCO would apply.
Planning Act 2008		The primary legislation that establishes the legal framework for applying for, examining and determining Development Consent Order applications for Nationally Significant Infrastructure Projects.
Project road		The new A122 trunk road, the improved A2 trunk road, and the improved M25 and M2 special roads, as defined in Parts 1 and 2, Schedule 5 (Classification of Roads) in the draft Development Consent Order (Application Document 3.1).
Project route		The horizontal and vertical alignment taken by the Project road.
South East Research Framework	SERF	The research framework setting out an agenda for heritage work in the South East

Term	Abbreviation	Explanation
South Portal		The South Portal of the Project (southern tunnel entrance) would be located to the south-east of the village of Chalk. Emergency access and vehicle turn-around facilities would be provided at the tunnel portal. The tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations.
The tunnel		Proposed 4.25km (2.5 miles) road tunnel beneath the River Thames, comprising two bores, one for northbound traffic and one for southbound traffic. Cross-passages connecting each bore would be provided for emergency incident response and tunnel user evacuation. Tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations. Emergency access and vehicle turn-around facilities would also be provided at the tunnel portals.

Annexes

Annex A Public Archaeology and Community Engagement

A.1 Introduction

- A.1.1 This Public Archaeology and Community Engagement (PACE) Strategy presents the overarching strategy for the outreach and engagement programme.
- A.1.2 The Strategy will be developed in collaboration with wider outreach and communication strategies developed by the Project.
- A.1.3 The Strategy includes site-based activities, initiatives to be undertaken while site work is ongoing, and activities to be undertaken throughout the post-excavation phase.
- A.1.4 The initiatives aim to maximise the potential influence and learning opportunities resulting from the archaeological works, providing information to the widest variety of audiences, ranging from members of the public living in the vicinity of the Project to visitors to the area.
- A.1.5 It is acknowledged that the events and activities proposed often attract the same group of people every time, generally including those who would frequent local museums and heritage attractions. The Strategy set out below is intended to also reach those who would not usually engage with archaeology or community heritage in the wider area, to create a lasting legacy to the archaeological and other heritage works undertaken as part of the Project.
- A.1.6 The post-excavation phase will focus on making information available in more permanent formats, such as exhibitions, printed and pdf format booklets and web-based media. Lectures could be provided to groups with a specific interest in the archaeology of the area during this phase, though it is noted that this form of outreach is self-selecting and not especially effective in reaching significant audiences: resources are better focused on more general information provision.
- A.1.7 The Archaeological Contractor(s) will prepare a Project specific PACE Strategy, detailing the results of audience mapping, the targeted audiences and the activities to be undertaken. This will include a programme of activities throughout the project lifecycle.
- A.1.8 Given the pace of the development in digital platforms, artificial intelligence and handheld technology it is expected that archaeological contractors will use the most appropriate delivery mechanisms for each outreach and engagement activity.

A.2 Aims and objectives

A.2.1 Key research objectives to be inserted.

A.2.2 The aim of the PACE Strategy will be to raise awareness of the significance of the archaeological landscape, to provide a lasting legacy of the archaeological works, and to encourage the enjoyment, interaction and engagement with the archaeological process and discoveries arising from the mitigation works undertaken along the Project.

A.2.3 The objectives of the PACE programme will be:

- a. Engagement and appreciation: Encouraging engagement with and appreciation of the archaeological landscape;
- b. Provide a sense of place: Encouraging a connection to the area for local residents and visitors;
- c. Knowledge about archaeology along the Project corridor: Advancing public understanding and stimulating interest and public curiosity about archaeology along the Project;
- d. Public understanding of developer-led archaeology: Making the archaeological process more understandable for the public, particularly in relation to a major road scheme, explaining why the sites selected for investigation have been chosen;
- e. Accessible learning: Creating accessible learning opportunities for people to be involved in actively discovering more about their past;
- f. Disseminating fieldwork information: Disseminating information about the archaeology along the Project to schools, the local community, local societies and groups with a keen interest in history and archaeology, and the academic community via a variety of platforms;
- g. Sharing research: Showcasing the research impact of development-led archaeological fieldwork and how it can inform our understanding of the past with local and national audiences, including academic interest; and
- h. Inclusive participation: Encouraging engagement with those that may not normally engage with archaeology or local history.

A.3 Audience mapping

A.3.1 A successful PACE Strategy must consider both who the audience is and the activities they want to partake in. The Strategy should be tailored to meet the needs of the identified audience, and provide engaging activities to add enjoyment. Outreach has traditionally been focused on a similar range of

activities, such as public talks and site tours, but consideration should be given to other activities to widen the audience.

- A.3.2 A recent report on *Heritage, Health and Wellbeing* from the Heritage Alliance (2020) states that the intended audience should be engaged with from the outset. They state: “Your target audience is likely to know what will work for them. By engaging with them from the very beginning, you can shape your project to suit their needs most appropriately.”
- A.3.3 This was reflected in the lessons learnt from the A14 Scheme (MHI 2019). This scheme found that implementing the community engagement at an earlier point in the project would have allowed for communication with local community groups to identify their “needs or desires”.
- A.3.4 The activities presented in the Suggested Activities section below are just that – suggestions. The audience mapping will dictate the requirements of the identified audiences and the types of activities they will engage with.
- A.3.5 To undertake the audience mapping, the Archaeological Contractor should utilise existing datasets available in relation to audiences in the region, then liaise with relevant groups to identify their needs.
- A.3.6 The initial analysis will inform the key proposals for engagement activities and themes which should be refined through consultation with the groups identified.
- A.3.7 The PACE Strategy is likely to predominantly focus on those communities directly impacted by the Project, or in its immediate vicinity, specifically those people living and working within or adjacent to the Project corridor, and those passing through it. The academic community at relevant universities may also be targeted, through activities such as presentations at conferences, along with the promotion of events or exhibits that may engage with or encourage those who do not normally engage with those targeted by these sorts of events. This will increase the impact of the outreach and the overall project legacy.
- A.3.8 Audiences could comprise:
- a. Local communities,
 - b. Primary and secondary school pupils and teachers;
 - c. Local history groups, both within the Project area and the wider area, including history groups in other villages in the wider area;
 - d. Members of local archaeology, history and civic societies;
 - e. Council for British Archaeology (CBA) Young Archaeology Clubs, CBA regional groups;
 - f. Higher education students, including archaeology students;

- g. Academic archaeologists and members of subject and period specialist societies;
- h. Interest-focused and period-focused archaeological research groups; and
- i. Visitors to the area and people travelling through the landscape.

A.3.9 Other groups should not be discounted at this stage, and an approach to reaching non-traditional audiences developed.

A.4 Suggested activities

A.4.1 A range of outreach and public archaeology activities should be proposed. These need to be tailored to the wants and needs of the differing audiences to maximise benefit. The audience mapping will be key to developing this.

A.4.2 Activities should be split across the different phases of archaeological work, including excavation and post-excavation. Later phases of work will provide different types of activity, although there will be some overlap (such as talks to local groups).

A.4.3 The lessons learnt from the A14 (MHI 2020) should be considered when planning events. That document includes detailed information and feedback on the activities that took place.

A.4.4 The following list of suggested activities may not all take place, and other activity types may be more appropriate. As stated above, the public consultation will determine the exact requirements.

A.4.5 At all stages the research questions of the Project should be considered, to ensure that the knowledge gained from the Project is disseminated to the public.

A.4.6 Activities that could be considered are as followed. Please note that this list is not exhaustive, and it is possible that following audience mapping some activities may not be wanted by the target audiences, and that other activities could be identified:

- a. A series of presentations to local groups and communities, both during excavation and post-excavation;
- b. Site tours during excavations;
- c. Community excavation or other fieldwork event (subject to suitable sites, access and health and safety);
- d. Liaison with local schools, including educational events, talks and finds handling, continuing to participate in STEM events as well as the provision of teaching materials;

- e. Project website including information such as dig diaries, key finds, videoblogs from site, post-excavation analysis etc.;
- f. Provision of information via social media platforms, such as Twitter, Facebook and Instagram, relevant platforms should be identified through age related focus groups to ensure an effective approach for a younger audience alongside a more established audience;
- g. Reaching a new audience. Activities and displays focused around popular non-heritage events. This strategy minimises the requirement for marketing, as it would make use of existing events that have their own promotional scheme in place. For example, a stall at local food festival could introduce participants to the weird and wonderful world of Roman foods - with information boards, finds from the sites, and food preparation exhibits. Tailored to location;
- h. Attendance at local history, archaeology or other heritage events;
- i. Pop-up displays of artefacts and information at community hubs or museums;
- j. Travelling display similar to the 'Time Truck' used on the A14. The A14 Highways England display vehicle will be used on the A428, it can have some information about archaeology on the interchangeable boards. This allows information to be presented at locations such as supermarkets or service areas which will provide access to heritage for those who might not normally engage with it;
- k. Permanent displays at a relevant location, such as the Northstowe Heritage Centre;
- l. Production of one or more popular publications, on the Project as a whole, or covering thematic topics. A booklet for children should be considered;
- m. Mapping of features from historic maps;
- n. Contribution to academic and professional conferences (such as ClfA) and publication of papers;
- o. Artefact handling sessions;
- p. Volunteer involvement in off-site post-excavation, such as finds cleaning, processing and recording, subject to regulations regarding the use of volunteers on development-led archaeological projects; and
- q. Provision of permanent information panels at suitable locations.

A.5 Measuring impact

- A.5.1 The impact of the outreach and public engagement activities shall be measured to identify the change of participant's perceptions of heritage, as well as to identify any benefits to wellbeing, sense of place, social interaction, provision of creative and cultural opportunities and understanding of archaeology and the Project.
- A.5.2 Data will need to be collated prior to the start of the PACE activities to provide a baseline against which to measure. Ongoing data collection, including participant numbers where applicable, will be required to allow change to be assessed. Feedback survey forms should be provided at events to allow the procurement of data, or 'exit surveys' undertaken at events.
- A.5.3 All survey and feedback information (hard copy, social media analytics and visitor comments) should be collated and presented in an accessible, distilled format within a report that describes the intended and actual outcomes of the programme. This should also consider lessons learnt from the PACE activities from the Project.

Annex B Table of mitigation sites

B.1 Introduction

B.1.1 This annex sets out the mitigation for the Project. The various heritage assets have been grouped into mitigation site. The mitigation sites are being developed with the Local Authority Archaeological Advisors. The mitigation sites are presented below at this deadline in tabular format by area, while a series of plates is being prepared to show each mitigation site from south to north, in relation to the Project.

B.2 Consultation on archaeological mitigation areas

B.2.1 The Local Authority Archaeological Advisors and Historic England have been engaged in developing the dAMS-OWSI. In addition to the consultation described within Table 6.1 of the ES Chapter 6: Cultural Heritage, the Local Authority Archaeological Advisors have been specifically consulted on the approach to defining mitigation areas and are engaged in the development of mitigation sites.

Table B.1 Outline of Consultation on archaeological mitigation areas

Stakeholder	Date	Format	Comments
Essex County Council	02.03.23	Teams Meeting	Mitigation workshop. Discussed and agreed all archaeological mitigation sites in Essex with a small number of exceptions to be agreed at a later date/TBC dependent on further information.
Kent County Council	20.03.23	Teams meeting	Mitigation workshop. Discussed producing a wireframe model showing depths of soil above archaeology in different areas. Discussed woodland planting and removal and land management agreements for archaeology being preserved in situ. Discussed different types of archaeological mitigation and Palaeolithic investigations.
Kent County Council	18.04.23	Teams Meeting	Mitigation workshop. Discussed methodology for different environmental mitigation and how this might impact archaeology. Discussed mapping historical periods more accurately in the GIS data.
Kent County Council	19.07.23	Teams Meeting	Brief informal catch-up on mitigation design progress. The Applicant explained detailed dataset informing mitigation including “site type” and detailed “historic period” characterization of the GIS data.

Stakeholder	Date	Format	Comments
			The Applicant showed the archaeological mitigation data that had been agreed with Essex County Council and talked through the process of how the mitigation areas were designed and agreed.
Kent County Council	16.08.23	Teams Meeting	Mitigation workshop. The Applicant set out in detail and discussed the evidence base and process informing the archaeological mitigation design.
Kent County Council	20.09.23	Teams Meeting	Brief informal catch-up on mitigation design progress and recap of previous informal data issues.
London Borough of Havering	27.09.23	Teams meeting	Mitigation workshop. The Applicant explained detailed dataset informing mitigation including “site type” and detailed “historic period” characterization of the GIS data. The Applicant showed the archaeological mitigation data that had been agreed with Essex County Council and talked through the process of how the mitigation areas were designed and agreed. Agreed a number of London Borough of Havering archaeological mitigation sites between Dennises Lane and Hobbs Hole.
Kent County Council EPS GLAAS HE	26.10.23	Teams Meeting	General meeting reviewing progress on mitigation and agreeing a common approach to various archaeological activities
Essex County Council	08.11.23	Teams Meeting	Mitigation workshop. The Applicant set out in detail and discussed the evidence base and process informing the archaeological mitigation design
Kent County Council	15.11.23	Teams Meeting	Mitigation workshop. The Applicant set out in detail and discussed the evidence base and process informing the archaeological mitigation design
Essex County Council	27.11.23	Teams Meeting	Agreement of mitigation sites and methodologies
London Borough of Havering	27.11.23	Teams Meeting	Agreement of mitigation sites and methodologies
Kent County Council	29.11.23	Teams Meeting	Agreement of mitigation sites and methodologies

B.3 Archaeological mitigation sites in Kent

B.3.1 The table below sets out the mitigation sites and proposed mitigation being developed in consultation with the relevant Local Authority Archaeological Advisors in Kent.

Table B.2 Archaeological Mitigation Areas in Kent

Site	Description	Assets number(s)	Proposed mitigation measures
K1	Land Between Thong Lane and Rochester Road	675, 775, 776, 777, 792, 801, 802, 805, 810, 1372, 1396, 1459, 1579, 1604, 1606, 1609, 1622, 4608, 4609. 4611, 4612	Evaluation
K2	Late Iron Age to Roman enclosure	1608	Detailed Excavation
K3	Roman rectangular enclosure	1607	Detailed Excavation
K4	Prehistoric funerary and settlement activity	1620	Detailed Excavation
K5	Sub-circular enclosure and possible barrow	2308	Detailed Excavation
K6	Large multi-period site south of A226		Detailed Excavation
K7	Areas of activity, boundaries and trackways outlying large multi-period site		SMS and Detailed Excavation
K8	Bronze Age and Iron Age activity, cremations		SMS and Detailed Excavation
K9	Multi-period activity and barrows		SMS and Detailed Excavation
K10	Possible ring ditch		Strip Map and Sample
K11	Possible Roman villa and burnt mound to south		Detailed Excavation
K12	Area around Roman villa, dispersed undated, Prehistoric and Roman activity. Roman metalled holloway		Strip Map and Sample
K13	Barrow and nearby ditches		Detailed Excavation
K14	Barrow, burnt mound and cremation		Detailed Excavation

Site	Description	Assets number(s)	Proposed mitigation measures
K15	Undated ditches and bit with burnt animal remains		Strip Map and Sample
K16	Multiple Roman enclosures and Medieval kiln/corn dryer		Preservation <i>in situ</i>
K17	Undated pits and ditches		Preservation <i>in situ</i>
K18	Iron Age settlement with granary and Bronze Age activity to east		SMS and Detailed Excavation
K19	Undated possible cremation cemetery		Detailed Excavation
K20			SMS and Detailed Excavation
K21			Preservation <i>in situ</i>
K22	Multiple areas of Prehistoric and Roman settlement activity, further remains outlying a Bronze Age enclosure to south.		SMS and Detailed Excavation
K23	Sub-rectangular Roman enclosure north of the A226	1814	Detailed Excavation
K24	Area of dispersed pits, ditches and postholes outlying Roman enclosure 1814	3798	Strip Map and Sample
K25	Medieval. Bronze and Iron Age activity south of Lower Higham Road	3852, 3854	Strip Map and Sample
K26	Multiple phases of Prehistoric activity within colluvial buried land surfaces	4595	Detailed Excavation
K27	Proposed drainage and access areas, Westcourt Marshes		Watching Brief
K28	Construction Compound CA 3B	1282, 1422, 1449	TBC
K29			TBC
K30	Part of area of undated pits, ditches and postholes not preserved <i>in situ</i>	4424	Strip Map and Sample
K31			Preservation <i>in situ</i>

Site	Description	Assets number(s)	Proposed mitigation measures
K32			Strip Map and Sample
K33			Preservation <i>in situ</i>
K34			TBC
K35			Detailed Excavation
K36			Detailed Excavation
K37			Strip Map and Sample
K38			Strip Map and Sample
K39			SMS and Detailed Excavation
K40			Strip Map and Sample
K41			LUP/Meso
K42			LUP/Meso
K43			Strip Map and Sample
K44			Detailed Excavation
K45			Preservation <i>in situ</i>
K46			Evaluation
K47			Evaluation
K48			Evaluation
K49	Targeted on geophysical survey anomalies		Strip Map and Sample
K50	Targeted on geophysical survey anomalies		Strip Map and Sample
K51	Colluvial layers and buried land surface with flint, grains and pot of probable LBA date. Archaeology is over 1m bgl and deepest part over 1.5m bgl.		Preservation <i>in situ</i>
K52			Geoarchaeological
K53			Preservation <i>in situ</i>
K54			Preservation <i>in situ</i>
K55			TBC
K56			LUP/Meso
K57			SMS and Detailed Excavation
K58			Preservation <i>in situ</i>
K59			Preservation <i>in situ</i>

Site	Description	Assets number(s)	Proposed mitigation measures
K60			TBC
K61			LUP/Meso
K62	Linear and pit like geophys anomalies between trial trenches.		Preservation <i>in situ</i>
K63			Preservation <i>in situ</i>
K64			Preservation <i>in situ</i>
K65	Deep colluvial sequence with LBA/EIA material and possible soil horizon outside in Tr 48 to the north.		TBC
K66			Evaluation
K67			Evaluation
K68			Evaluation
K69			Evaluation
K70			Evaluation
K71			Evaluation
K72			Evaluation
K73			Evaluation
K74			Evaluation
K75	Area of dispersed pits, ditches and postholes outlying Roman enclosure 1814	3798	Strip Map and Sample
K76			Geoarchaeological
K77			Strip Map and Sample
K78			Watching Brief
K79	Isolated NNW-SSE ditch, may be Post-Med but unproven		Strip Map and Sample
K80	Geophysical survey anomalies at edge of dry valley		Strip Map and Sample
K81	Geophysical survey anomalies south of IA-Roman enclosure		Strip Map and Sample
K82			Geoarchaeological
K83			Geoarchaeological

B.4 Archaeological mitigation sites in Essex

B.4.1 The table below sets out the mitigation sites and proposed mitigation agreed with the relevant Local Authority Archaeological Advisors in Essex.

Table B.3 Archaeological Mitigation Areas in Essex

Site	Description	Asset number(s)	Proposed mitigation measures
E1	A series of circular and rectilinear cropmark features West of Coalhouse Fort	159, 289, 348, 723, 741, 1833	3.3 Geophysical Survey 1.1 Avoidance 4.2 Detailed Excavation
E3	Roman riverside settlement at East Tilbury Foreshore	412	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E4	Possible saltern, West side of East Tilbury Marshes and Anti-glider ditches SW of Bowaters Farm	349, 502	4.3 Strip, Map and Sample Excavation
E5	Roman saltern, East Tilbury - Bowaters Farm and Anti-glider ditches SW of Bowaters Farm	349, 442	4.3 Strip, Map and Sample Excavation
E6	Medieval to Post-Medieval marshland drainage and enclosure predominantly Tudor in date	349, 4622	4.3 Strip, Map and Sample Excavation
E7	A multi-period site with settlement and salt-making industry with activity from the Neolithic to the Early Medieval Period, with subsequent Medieval agricultural activity and an undated unurned cremation	496	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E8	A flint surface or track beneath a buried soil deposit of possible Early Iron Age date and Anti-glider ditches SW of Bowaters Farm	349, 4623	4.3 Strip, Map and Sample Excavation
E9	Late Neolithic struck flint flakes, burnt flint and deeply buried organic material	4620	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E10	Adjacent to the site of Roman urned cremations discovered during construction of the railway	410	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E11	Some indications from Thamesgate ATT of truncated Prehistoric boundaries and possible settlement activity, but sporadic compared to areas to NW across railway and SE outside Order Limits.	104, 451, 638, 761	4.3 Strip, Map and Sample Excavation
E12	Area is focussed on probable red hill anomaly from Barville solar farm geophys survey	144, 161, 350	1.0 Preservation <i>in situ</i>
E13	Area is focussed on probable red hill anomaly from Barville solar farm geophysics survey	144, 161, 350	1.0 Preservation <i>in situ</i>
E14	Prehistoric - Ringditch and linears from aerial mapping	452, 761	3.3 Geophysical Survey 1.1 Avoidance 4.2 Detailed Excavation
E15	Bronze Age findspot and East Tilbury settlement activity.	438, 761	3.3 Geophysical Survey 1.1 Avoidance 4.2 Detailed Excavation
E16	WWII Anti-glider ditch and East Tilbury settlement activity.	350, 761	3.3 Geophysical Survey 1.1 Avoidance 4.2 Detailed Excavation
E18	The site of Wick House and later WWII Anti-glider ditches.	349, 499	4.3 Strip, Map and Sample Excavation
E19	Bronze Age funerary activity and possible Bronze Age or Early Medieval settlement activity, identified during trial trenching.	3670, 3671, 3676	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E20	Bronze Age settlement activity identified during trial trenching.	3675, 3676	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E21	Bronze Age settlement, with some potential earlier (Mesolithic/Early Neolithic flint) and later Prehistoric activity, identified during trial trenching.	3677, 3678, 3703, 4624	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E23	Bronze Age field system.	4625	4.3 Strip, Map and Sample Excavation
E24	Prehistoric to Roman cropmark complex, with some Early Neolithic/Bronze Age	450, 3668	1.0 Preservation <i>in situ</i>

Site	Description	Asset number(s)	Proposed mitigation measures
	artefacts recovered during trial trenching.		
E25	Roman Settlement activity	104, 493	1.0 Preservation <i>in situ</i>
E26	Trial trenching identified a pit with Neolithic/Bronze Age artefacts.	3914	1.0 Preservation <i>in situ</i>
E27	Roman settlement activity, including activity identified during trial trenching.	493, 3908, 3911, 3918, 3920, 3925, 3926	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E28	Late Prehistoric tree throw identified during trial trenching.	3959	Agreed with Local Authority Archaeological Advisor no further work required
E29	Undated features identified during trial trenching.	4771	Agreed with Local Authority Archaeological Advisor no further work required
E30	Prehistoric artefact scatters identified during trial trenching.	3904, 3907	1.0 Preservation <i>in situ</i>
E31	Roman activity identified during trial trenching.	3921	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E32	Roman activity identified during trial trenching.	3921	1.0 Preservation <i>in situ</i>
E33	Roman activity identified during trial trenching.	3921	1.0 Preservation <i>in situ</i>
E34	Roman activity identified during trial trenching.	3921	4.3 Strip, Map and Sample Excavation
E35	Mesolithic activity identified during trial trenching.	3905	1.0 Preservation <i>in situ</i>
E36	Mesolithic activity and a Medieval farmstead identified during trial trenching.	3905, 3924	1.0 Preservation <i>in situ</i>
E37	Mesolithic activity and a Medieval farmstead identified during trial trenching plus Prehistoric macehead.	21, 3905, 3924	1.0 Preservation <i>in situ</i>
E38	Mesolithic activity and a Medieval farmstead identified during trial trenching.	3905, 3924	4.3 Strip, Map and Sample Excavation
E39	Area of Prehistoric activity formed of Upper Palaeolithic artefacts and Mesolithic to	3903, 3904, 3905, 3906, 3907	4.2 Detailed Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
	Bronze Age find assemblages; identified during trial trenching.		
E40	Activity identified through trial trenching which included Medieval dated ditches and a pit containing a fragment of ceramic building material.	4772, 4773, 4774	Agreed with Local Authority Archaeological Advisor no further work required
E41	Iron Age settlement activity identified during trial trenching.	3918	1.0 Preservation <i>in situ</i>
E42	Area of Iron Age activity.	432	4.3 Strip, Map and Sample Excavation
E43	Early Medieval activity identified during trial trenching.	3923	4.3 Strip, Map and Sample Excavation
E44	Early Medieval activity identified during trial trenching.	3923	1.0 Preservation <i>in situ</i>
E45	Early Medieval activity identified during trial trenching.	3923	4.3 Strip, Map and Sample Excavation
E46	Area of Iron Age to Roman industrial activity identified during trial trenching; including possible earlier activity identified through Mesolithic flint.	3601, 4770	4.3 Strip, Map and Sample Excavation
E47	Area of Iron Age to Roman industrial activity identified during trial trenching.	3601	1.0 Preservation <i>in situ</i>
E48	Area of Bronze Age activity believed to be associated with salt production. Identified during trial trenching.	3916	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E49	U-shaped settlement enclosure of Middle Bronze Age to Iron Age date, identified during trial trenching.	3553	4.3 Strip, Map and Sample Excavation
E50	U-shaped settlement enclosure of Middle Bronze Age to Iron Age date, identified during trial trenching	3553	1.0 Preservation <i>in situ</i>
E51	Sequence of colluvial layers identified during trial	3957	Agreed with Local Authority Archaeological

Site	Description	Asset number(s)	Proposed mitigation measures
	trenching, which included buried soils containing later Prehistoric artefacts.		Advisor no further work required
E52	Pit with late Bronze Age/early Iron Age pottery, identified during trial trenching.	3917	Agreed with Local Authority Archaeological Advisor no further work required
E53	Area of Bronze Age to Iron Age activity, Prehistoric findspots associated with colluvial layers, identified during trial trenching.	3554, 3599, 3922	4.3 Strip, Map and Sample Excavation
E55	Colluvial layers with Late Mesolithic, Bronze Age and Iron Age pottery, identified during trial trenching.	3599	4.3 Strip, Map and Sample Excavation
E57	Late Neolithic to Bronze Age funerary activity and undated ditches/archaeological features identified during trial trenching.	3619, 4769	4.3 Strip, Map and Sample Excavation
E58	Late Neolithic to Bronze Age funerary activity, identified during trial trenching.	3619	1.0 Preservation <i>in situ</i>
E59	Middle to Late Bronze Age activity, identified during trial trenching, as dispersed pits, ditches and postholes.	4768	Agreed with Local Authority Archaeological Advisor no further work required
E60	Settlement activity dated to the Bronze Age to Iron Age, with later Medieval quarry pits identified during trial trenching.	3559, 3598	4.3 Strip, Map and Sample Excavation
E61	Settlement activity dated to the Bronze Age to Iron Age, identified during trial trenching.	3598	4.3 Strip, Map and Sample Excavation
E62	Settlement activity dated to the Bronze Age to Iron Age, identified during trial trenching.	3598	1.0 Preservation <i>in situ</i>
E63	Settlement activity dated to the Bronze Age to Iron Age, identified during trial trenching.	3598	1.0 Preservation <i>in situ</i>

Site	Description	Asset number(s)	Proposed mitigation measures
E64	Settlement activity dated to the Bronze Age to Iron Age, identified during trial trenching.	3598	4.3 Strip, Map and Sample Excavation
E65	Undated ring ditch, identified through the Historic Environment Record, to the west of Brook Farm.	259	4.3 Strip, Map and Sample Excavation
E66	Features, dated to the Neolithic, identified during trial trenching.	3594	4.3 Strip, Map and Sample Excavation
E67	Features, dated to the Neolithic, identified during trial trenching.	3594	4.3 Strip, Map and Sample Excavation
E68	Prehistoric trackway identified during trial trenching.	4764	4.3 Strip, Map and Sample Excavation
E69	Prehistoric ditches and pits, likely representing the periphery of settlement activity. Identified during trial trenching.	4767	Agreed with Local Authority Archaeological Advisor no further work required
E70	Ring ditch, identified through the Historic Environment Record.	342	4.3 Strip, Map and Sample Excavation
E71	Ring ditch identified through the Historic Environment Record, with later Post Medieval enclosure arrangement identified through trial trenching.	342, 3576	1.0 Preservation <i>in situ</i>
E72	A concentration of pits and ditches identified during trial trenching, which yielded predominantly Neolithic to Bronze Age material within the area.	3572, 3592	4.3 Strip, Map and Sample Excavation
E73	A concentration of pits and ditches identified during trial trenching, which yielded predominantly Neolithic to Bronze Age, and later Iron Age to Roman material within the area. Activity is suggestive of settlement activity, with some trackways also present. A later Post Medieval enclosure system was also	3572, 3573, 3576, 3591, 3592, 4764	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
	evident within the area, during trial trenching.		
E74	Orsett Causeway site, with the area principally covered by Medieval to Post Medieval field systems. Trial trenching also identified the remains of the now demolished Seaborough Hall. Seaborough Hall is present on OS mapping, including nearby well.	211, 212, 213, 715, 1808, 3577, 4174	4.3 Strip, Map and Sample Excavation
E75	Orsett Causeway site, with ditches suggestive of enclosure activity, dating from as early as the Neolithic. Trial trenching also identified activity dating from the Iron Age within the proposed area.	7, 212, 213, 3574	4.3 Strip, Map and Sample Excavation
E76	Orsett Cropmark enclosure, identified through Essex HER.	482	Agreed with Local Authority Archaeological Advisor no further work required
E77	Medieval kiln, with undated trackway feature identified during trial trenching.	3588, 3589	4.3 Strip, Map and Sample Excavation
E78	A concentration of Prehistoric activity identified through trial trenching. The material recovered dated from the Neolithic to Iron Age, and included two Early Bronze Age decorated beakers.	3627	4.3 Strip, Map and Sample Excavation
E79	A concentration of Prehistoric activity identified through trial trenching. The material recovered dated from the Neolithic to Iron Age and included two Early Bronze Age decorated beakers.	3627	4.3 Strip, Map and Sample Excavation
E80	Potential Prehistoric settlement activity, identified through the Historic Environment Record.	262	Agreed with Local Authority Archaeological Advisor no further work required
E81	Concentration of Bronze Age activity identified during trial trenching.	3565	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E82	Neolithic to Roman activity identified through the Historic Environment. The remains were confirmed through trial trenching which identified pits/ditches containing Late Neolithic to early Bronze Age material and a later Roman enclosure settlement.	245, 325, 3567, 3729	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E83	Trial trenching identified an area of Roman activity, likely representing an enclosure. A later Medieval enclosure was also identified through the trial trenching.	3732, 3765	4.3 Strip, Map and Sample Excavation
E84	Concentration of Prehistoric activity identified during trial trenching. Features included pits and ditches yielding Bronze Age artefacts, as well as later Roman activity and a possible Post Medieval building, also present within the area.	3724, 3735, 3762	4.3 Strip, Map and Sample Excavation
E85	Concentration of features identified during trial trenching. Features included Bronze Age to Iron Age activity, as well as two isolated Early Medieval and Medieval dated pits; suggesting later activity.	2723, 3726, 3733, 3734	4.3 Strip, Map and Sample Excavation
E86	Ring ditch identified through the Historic Environment Record and confirmed as the likely truncated remains of a Bronze Age barrow by trial trenching.	219	4.3 Strip, Map and Sample Excavation
E87	Post Medieval archaeological features identified by the Historic Environment Record.	246	4.2 Detailed Excavation
E88	A Bronze Age to Iron Age funerary landscape, which includes the presence of barrows, confirmed during trial trenching. A likely early Post Medieval field system was	231, 3624, 3625	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
	also identified within the location, during trial trenching.		
E89	Cropmarks identified in the Historic Environment Record of Bronze Age to Iron Age date; with activity confirmed during trial trenching.	356	4.3 Strip, Map and Sample Excavation
E90	Orsett Cropmark Complex. The asset was targeted during trial trenching and confirmed Bronze Age occupation activity, and multiple phases of Iron Age to Roman activity which encompasses agricultural, industrial and settlement activities.	SM1	4.3 Strip, Map and Sample Excavation
E91	Orsett Cropmark Complex. The asset was targeted during trial trenching and confirmed Bronze Age occupation activity, and multiple phases of Iron Age to Roman activity which encompasses agricultural, industrial and settlement activities.	SM1	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E92	Orsett Cropmark Complex. The asset was targeted during trial trenching and confirmed Bronze Age occupation activity, and multiple phases of Iron Age to Roman activity which encompasses agricultural, industrial and settlement activities.	SM1	4.3 Strip, Map and Sample Excavation
E93	Multi-period settlement activity identified through the Historic Environment Record. Trial trenching tested the asset and confirmed Iron Age to Roman settlement activity. The remains are a likely continuation of activity associated with SM1 directly to the south.	247, 248	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E94	Roman industrial and agricultural activity identified through trial trenching. Activity is likely associated with asset 247.	3615	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E95	Iron Age settlement activity identified through the Historic Environment Record as cropmarks.	2078	4.3 Strip, Map and Sample Excavation
E96	Cropmarks identified through the Historic Environment Record. During trial trenching, flint scatters suggesting a concentration of activity in the Mesolithic/Neolithic/Early Bronze Age were identified.	355, 3820	4.3 Strip, Map and Sample Excavation
E97	Trial trenching identified a Late Iron Age to Roman agricultural site, with later management into the Post Medieval. Trial trenching however, also suggested potential earlier activity with a Mesolithic worked flint recovered from one of the Iron Age to Roman features.	3879, 3897, 3898, 3899	4.3 Strip, Map and Sample Excavation 4.5 Geoarchaeological and palaeo-environmental investigation
E98	Trial trenching recovered a Mesolithic worked flint from the infill of a periglacial feature, suggestive of potential for further evidence of Mesolithic activity in the landscape to be present.	3878	4.6 Palaeolithic and Holocene intrusive investigation
E99	A series of heritage assets were identified during desk-based activities which require further assessment. These include a concrete platform of a potential unknown structure; a former farmstead; and further Post Medieval agricultural activity.	1864, 2062, 3883	4.4 Trial Trench Evaluation
E100	A potential Medieval moat was identified through the Historic Environment Record.	229	5.1 Archaeological monitoring and recording (watching brief)
E101	Cropmarks of a potential moat were identified through the Historic Environment Record.	267	Agreed with Local Authority Archaeological Advisor no further work required
E102	A concentration of Prehistoric activity was identified during trial trenching. The activity is location along the edges of a	4626	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
	floodplain and has the potential to yield evidence from as early as the Palaeolithic.		
E103	Trial trenching identified funerary activity through the recovery of a Bronze Age cremation burial which was unurned. Later human occupation was also identified through a potential Iron Age structure and the possibility of buried soils.	3936, 3940	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E104	A concentration of Prehistoric activity was identified during trial trenching. The activity is location along the edges of a floodplain and has the potential to yield evidence from as early as the Palaeolithic.	4626	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E105	An area of Late Bronze Age to Iron Age activity identified during trial trenching.	3841	Agreed with Local Authority Archaeological Advisor no further work required
E106	Aerial photography identified a series of earthworks to be of probable Post Medieval date. However, during trial trenching, an area of Late Prehistoric activity was identified.	1800, 3874	Agreed with Local Authority Archaeological Advisor no further work required
E107	Trial trenching identified a small group of struck flint of possible Mesolithic or Early Neolithic date. The flint scatter was associated with an alluvial deposit.	3952	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E108	Area of proposed utility logistics hub, not previously archaeologically tested by trial trenching.	N/A	4.3 Strip, Map and Sample Excavation
E109	Trial trenching identified a probable Medieval farmstead, with material suggesting an occupation between the 11 th and 15 th centuries.	3902	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E110	Trial trenching identified a concentration of activity dating from the Iron Age to Roman period.	3949	4.3 Strip, Map and Sample Excavation 4.5 Geoarchaeological and palaeo-environmental investigation
E111	Trial trenching identified an area of concentrated activity, formed of ditches and pits. Recovered material included Bronze Age to Iron Age material, such as pottery with associated hearth and cremated human remains.	3835	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E112	A possible enclosure site has been identified through cropmarks.	Targeted on partial rectilinear cropmark	4.3 Strip, Map and Sample Excavation
E113	Trial trenching identified multiple phases of human activity within the area. These included substation Prehistoric activity along a floodplain edge, from as early as the Palaeolithic; funerary activity through the recovery of a Bronze Age cremation burial which was unurned. Later human occupation was also identified through a potential Iron Age structure and the possibility of buried soils.	3936, 3940, 4626	4.6 Palaeolithic and Holocene intrusive investigation
E114	An area covering multi-period activities, including Roman salterns and crossed by second world war anti-glider ditches.	366, 349, 396, 442, 499, 502, 1794, 1795, 1797, 4622	4.6 Palaeolithic and Holocene intrusive investigation
E115	Trial trenching identified a concentration of Bronze Age activity.	3833	4.6 Palaeolithic and Holocene intrusive investigation
E116	Area of a Roman cremation cemetery, identified through desk sources. Trial trenching in the area identified a series of ditches and postholes, with predominately Iron Age material and some trial trenching.	682, 3847	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E119	Trial trenching confirmed the presence of ditches, containing some late Prehistoric pottery, some of which were potentially residual.	3845 and geophysical anomalies	Agreed with Local Authority Archaeological Advisor no further work required
E120	The Historic Environment Record mapped activity dating to the Medieval period, with aerial photography also picking up cropmarks of a possible Bronze Age barrow. Following trial trenching, activity within the area, principally dated to the Roman period, although further archaeological periods may still be present.	29, 1802, 3865, 3866	4.3 Strip, Map and Sample Excavation
E121	The Historic Environment Record identified enclosure activity dating to the Prehistoric, which was confirmed by trial trenching.	184	4.3 Strip, Map and Sample Excavation
E122	Trial trenching identified a concentration of ditches forming an Early Medieval enclosure.	3870	1.0 Preservation <i>in situ</i>
E123	Trial trenching identified a concentration of Roman ditches.	3687	4.3 Strip, Map and Sample Excavation
E124	Trial trenching identified a Medieval enclosure, with material dating between the 12 th and 14 th centuries.	3689	4.3 Strip, Map and Sample Excavation
E125	Trial trenching identified a large feature, which was not fully characterised due to the limitations of the trenching. Material from the feature included Bronze Age to Iron Age pottery.	3857	4.3 Strip, Map and Sample Excavation
E126	Trial trenching identified a ditch, believed to provide a linear boundary. The ditch included material dating from the Iron Age to Roman period.	3685	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E127	Trial trenching confirmed a concentration of ditches and pits, although with limited dating evidence.	361	4.3 Strip, Map and Sample Excavation
E128	The Historic Environment Record has identified an area of likely Prehistoric activity.	189	4.3 Strip, Map and Sample Excavation
E129	The Historic Environment Record has identified an area of likely Prehistoric activity.	189	5.1 Archaeological monitoring and recording (watching brief)
E130	The Historic Environment Record has identified an area of likely Prehistoric activity, with potential later use.	186, 189, 598 and cropmarks	4.3 Strip, Map and Sample Excavation
E131	The Historic Environment Record identified an area of settlement activity, principally dating from the Bronze Age to Iron Age, with trial trenching confirming some sporadic Roman activity.	117, 4763	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E132	The Historic Environment Record identified an area of settlement activity, principally dating from the Bronze Age to Iron Age, with trial trenching confirming some sporadic Roman activity.	117	4.3 Strip, Map and Sample Excavation
E134	Trial trenching identified a concentration of activity, dating from the Bronze Age to Iron Age.	3696	4.3 Strip, Map and Sample Excavation
E135	Earlier historic activity associated with the development of the modern-day settlement at East Tilbury has the potential to be present.	761	3.3 Geophysical Survey 1.1 Avoidance 4.2 Detailed Excavation
E136	Roman field system and periphery activity associated with known settlement activity.	104, 318, 493 and features from OA Linford ATT.	4.3 Strip, Map and Sample Excavation
E137	The Historic Environment Record identified a landscape of Prehistoric to Roman activity, which has been confirmed by trial trenching.	104, sub-rectangular enclosure and pit-like feature from LTC aerial mapping survey and ditches from OA Linford ATT	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
E138	Dry valley location with previously recorded Prehistoric and Roman remains, as well Neolithic activity identified during trial trenching.	104 and area of Neolithic activity identified from OA Linford ATT	4.3 Strip, Map and Sample Excavation
E140	The Historic Environment Record identified a landscape of Prehistoric to Roman activity, which has been confirmed by trial trenching. Some remains were dated to the Bronze Age.	104, 3704	4.3 Strip, Map and Sample Excavation
E141	Sparse archaeological activity identified during trial trenching.	None. Located on part of utility works immediately west of Tr 132 from OA Linford ATT which recorded pits, postholes and ditches.	4.3 Strip, Map and Sample Excavation
E142	Site of potentially archaeological anomalies from LTC geophysical survey	Site of potentially archaeological anomalies from LTC geophysical survey	4.3 Strip, Map and Sample Excavation
E143	Site of potentially archaeological anomalies from LTC geophysical survey	Site of potentially archaeological anomalies from LTC geophysical survey	4.3 Strip, Map and Sample Excavation
E144	Oyster beds close to Tilbury Power Station, identified through the Historic Environment Record.	346	To be confirmed.
E145	Bronze Age funerary landscape including several round barrows.	68, 318, 365, 444, 445, 446	4.2 Detailed Excavation
E146	Area of proposed utility logistics hub, not previously archaeologically tested by trial trenching.	N/A	4.3 Strip, Map and Sample Excavation
E147	Bronze Age to Iron Age settlement, identified during trial trenching.	3832, 3848	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
E148	Mitigation site is located 155m north of Prehistoric and other archaeological remains associated with the Hobbs	N/A	Agreed with Local Authority Archaeological Advisor no further work required

Site	Description	Asset number(s)	Proposed mitigation measures
	Hole Excavations (asset 168). However, no known remains are located within E148.		
E150	Roman Enclosure site identified through Essex HER.	493	1.0 Preservation <i>in situ</i>
E151	No assets recorded within the site but is in close proximity to SM7 (Springfield style enclosure and Iron Age enclosures, south of Hill House) and other cropmark features	None	4.3 Strip, Map and Sample Excavation
E152	No assets recorded within the site, but it is in close proximity to a known ring ditch.	None	4.3 Strip, Map and Sample Excavation
E153	Early Post Medieval quarrying activity identified during trial trench evaluation.	3674	1.0 Preservation <i>in situ</i>
E154	A series of Palaeolithic/Neolithic assets provide an indication for the high archaeological interest of the geological deposits. As a result, deep palaeo test pits to be excavated.	117, 189, 361, 3683, 3685, 3687, 3705, 4762, 4763	4.6 Palaeolithic and Holocene intrusive investigation

B.5 Archaeological mitigation sites in Havering

B.5.1 The table below sets out the mitigation sites and proposed mitigation being developed in consultation with the relevant Local Authority Archaeological Advisors in Havering.

Table B.4 Archaeological mitigation areas in Havering

Site	Description	Asset number(s)	Proposed mitigation measures
H1	Land south of Ockendon Rd, requires vegetation removal before archaeological works. Includes existing Estate House (4153) which is proposed for demolition,	No recorded archaeological assets, although built heritage asset Estate House 4153 is within this area and proposed for demolition	4.3 Strip Map and Sample

Site	Description	Asset number(s)	Proposed mitigation measures
H2	Multi-period activity across a wide area around Hobbs Hole	3713, 3721, 3722, 4627	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
H3	Northern part of site of EBA to EIA occupation and craftworking.	174, 190, 3832, 3840, 5110	1.0 Preservation <i>in situ</i>
H4	ATT on area including 2 rectilinear enclosures and ringditches	186, 595, 598, 605, 4761	4.4 Trial Trench Evaluation
H5	Areas of Early Med and Post-Med activity. Unevaluated area to south adjacent to multi-period activity and including an undated pit.	3683, 3848	4.3 Strip, Map and Sample Excavation
H6	Two separate areas of BA activity and 'blank' area in between, Medieval ditches containing residual Roman material.	3680, 3682, 3688	4.3 Strip, Map and Sample Excavation
H7	No ATT. To south, dispersed IA and Roman pits and ditches. To north, area where vegetation would be removed adjacent to a prehistoric occupation site (west of the M25)	611, 3876	4.3 Strip, Map and Sample Excavation
H8	Part of a Prehistoric occupation site impacted by utility diversions.	3837, 3846	4.2 Detailed Excavation
H9	Part of a Prehistoric occupation site impacted by Open Mosaic Habitat and part of the site between that landscaping and utility diversions.	3837, 3846	4.3 Strip, Map and Sample Excavation
H10	Part of a Prehistoric occupation site.	3837	4.2 Detailed Excavation
H11	Medieval and undated ditches with evidence for nearby arable farming. Related to features west of railway.	3846	Deleted
H12	Medieval agricultural and settlement-periphery activity.	594, 1810	4.3 Strip, Map and Sample Excavation
H13	Bronze Age to Iron Age occupation and ritual activity bisected by railway	3836	4.2 Detailed Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
H14	Roman agricultural activity with traces of residual ENEO or MNEO and EBA activity.	3712	4.3 Strip, Map and Sample Excavation
H15	Area proposed for multi-utility network diversions, route alignment earthworks, Mains Works Area in western part, WCH Route, landscape mitigation LE6.2 Banks and Ditches	None recorded	4.3 Strip, Map and Sample Excavation
H16	SMS on a NMU route through an area of Medieval to Post-Medieval settlement periphery activity	191, 192	4.3 Strip, Map and Sample Excavation
H17 North	LUP investigation with deep test pits, exact locations TBC. Also potential for shallower investigations of area of Pleistocene Gravel, Head and Brickearth deposits recorded near Hobbs Hole during ATT.	3713, 3721, 3722, 4627	4.6 Palaeolithic and Holocene intrusive investigation
H17 South	LUP investigation with deep test pits, exact locations TBC.	3713, 3721, 3722, 4627	4.6 Palaeolithic and Holocene intrusive investigation
H18	Area not evaluated. In proximity to known sites of Palaeolithic and later Prehistoric interest including cremations discovered during previous M25 widening.	None recorded	4.3 Strip, Map and Sample Excavation 4.6 Palaeolithic and Holocene intrusive investigation
H19	Wooded area, not evaluated. 60m west of multi-period site 3885 found by LTC ATT.	None recorded	4.3 Strip, Map and Sample Excavation
H20	Area around recorded cremation site asset 172, found previously during M25 widening and creation of Pond 1791.	None recorded	4.3 Strip, Map and Sample Excavation 4.2 Detailed Excavation
H21	SMS on OHL works area if its construction would result in below-ground impacts. Crosses Roman enclosure/field system 3891 and in close proximity to multi-period site 3885. Likely also crossed by Late Bronze Age/Early Iron Age trackway 3886	3891	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
H22	Groundworks for landscaping in large HER polygon 1751 recording a flint scatter around the stream and scatter of slag, Prehistoric and Roman pot to north. Findspots 617 (Roman) and 618 (unknown). Cropmarks of ditches and pits 624 and Prehistoric findspot 614 to south.	1751	4.3 Strip, Map and Sample Excavation
H23	Mitigation site contains part of an area with possible LBA-EIA settlement – small number of pits and postholes.	3887	4.3 Strip, Map and Sample Excavation
H24	Mitigation site contains part of an area with possible LBA-EIA settlement including small number of pits and postholes.	3887	1.0 Preservation <i>in situ</i>
H25	Area proposed for landscape mitigation LE8.1 Open Mosaic Habitat.	None recorded	4.4 Trial Trench Evaluation
H26	Area proposed for landscape mitigation LE8.1 Open Mosaic Habitat.	None recorded	4.4 Trial Trench Evaluation
H27	Western part of a Roman field/enclosure system.	3892	4.3 Strip, Map and Sample Excavation
H28	Eastern part of a Roman field/enclosure system.	3892	1.0 Preservation <i>in situ</i>
H29	Area proposed for flood compensation and other works adjacent to a tributary of the Mardyke in an area of alluvial deposits with archaeological potential. Some ATT may need to take place after vegetation removal.	None recorded	4.4 Trial Trench Evaluation

Site	Description	Asset number(s)	Proposed mitigation measures
H30	Area of Head Deposits and Boyn Hill Sand and Gravel with Palaeolithic potential.	None recorded	Agreed with Local Authority Archaeological Advisor no further work required
H31	Area of Alluvium and Head Deposits with Palaeolithic potential. Recorded assets are not the focus of this mitigation area.	3887, 3892	4.6 Palaeolithic and Holocene intrusive investigation
H32	Evaluation to take place following vegetation removal.	None	4.4 Trial Trench Evaluation
H33	Evaluation to take place following vegetation removal.	2024	4.4 Trial Trench Evaluation
H34	Evaluation to take place following removal of solar farm.	None recorded	4.4 Trial Trench Evaluation
H35	Evaluation following vegetation removal.	None recorded	Agreed with Local Authority Archaeological Advisor no further work required
H36	Geophysical survey unlikely to be practical here due to gravelled areas and elements of modern development. ATT recommended.	None recorded	4.3 Strip, Map and Sample Excavation
H37	Undated posthole/stakehole and ditches recorded during LTC ATT WSI N.	5031	1.0 Preservation <i>in situ</i>
H38	Undated posthole/stakehole and ditches recorded during LTC ATT WSI N. This mitigation site includes a ditch and area to east that was not trenched.	5031	4.3 Strip, Map and Sample Excavation

Site	Description	Asset number(s)	Proposed mitigation measures
H42	Area proposed for multi-utility network diversions, utility working areas, landscape mitigation LE8.1 Open Mosaic Habitat.	3846	4.3 Strip, Map and Sample Excavation
H43	Area mostly proposed for landscape mitigation LE8.2 Ancient Woodland Mitigation Planting with some multi-utility network diversions in southern part.	None recorded	4.4 Trial Trench Evaluation
H44	Mitigation site located c. 20m south of buildings on C19 OS map at Tabrams, farmstead or house of Medieval origin. At least one deep trench to detect Medieval north–south routeway.	None recorded	4.4 Trial Trench Evaluation
H45	Mitigation site located c. 100m south of former Medieval building(s) at Tabrams. At least one deep trench to detect Medieval north–south routeway.	None recorded	4.4 Trial Trench Evaluation
H46	Vegetation removal required first. No archaeology recorded here, but Prehistoric remains recorded during M25 expansion to east.	None recorded.	4.3 Strip, Map and Sample Excavation
H47	Area adjacent to Medieval and Post-Medieval buildings 712 removed by M25. Possible cropmark enclosure 584. Infilled pond 4204 is recorded on C19 map.	584, 4204	4.4 Trial Trench Evaluation

Annex C Outline Palaeolithic Written Scheme of Investigation

C.1 Approaches to mitigation

General

- C.1.1 This Outline Palaeolithic Written Scheme of Investigation (OPWSI) sets out the approach to the essential mitigation for Palaeolithic heritage assets identified within ES Chapter 6: Cultural Heritage for the A122 Lower Thames Crossing (the Project).
- C.1.2 Palaeolithic heritage assets can be affected as follows:
- a. Physical impacts to non-designated near-surface archaeological remains and palaeoenvironmental deposits during the construction phase
 - b. Physical impacts to non-designated deeply buried archaeological remains and palaeoenvironmental deposits during the construction phase
- C.1.3 The OPWSI specifically addresses the approach to non-designated deeply buried archaeological remains and palaeoenvironmental deposits. The near-surface archaeological remains and palaeoenvironmental deposits are addressed within the main text of the dAMS-OWSI.
- C.1.4 Using geological mapping, geological borehole logs and available data from the ground investigation programme, a sub-surface Quaternary deposit model for the area of the Project's footprint was developed. Following a desk-based review of known Palaeolithic sites and find-spots, the Project area was divided into 29 character areas based on Quaternary deposit character and Palaeolithic potential, and 34 actual Palaeolithic and Quaternary (PQ) zones (PQ 1-11, 12a-b, 13-19, 20a-c, 21, 22a-b, 23a-b and 24-29, since several areas of similar character are not directly contiguous).[Document Reference APP-356 6.3 Environmental Statement - Appendix 6.5 - Lower Thames Crossing - Palaeolithic and Quaternary Deposit Model (PQDM) and Desk-based Assessment of Palaeolithic Potential]
- C.1.5 Each PQ zone was attributed to one of three categories of Palaeolithic/Quaternary potential (uncertain, low-moderate and moderate-high), based on a matrix combining the likelihood of encountering Palaeolithic remains with the likely importance of any remains present.
- C.1.6 Sites that require Palaeolithic mitigation are identified within Annex B: Table of Mitigation Sites.

Site Specific Written Schemes of Investigation and method statements

- C.1.7 Site Specific Written Schemes of Investigation (SSWSIs) will be prepared setting out in detail specific mitigation measures for the detailed design of the Project, informed by the strategy described in the AMS-OWSI. This process is set out in paragraphs 7.1.3 to 7.1.8 of the main text of the dAMS-OWSI, and these will apply to the Palaeolithic mitigation.

Palaeolithic archaeological project team

- C.1.8 The main project team for archaeological work is set out in paragraph 7.1.10 of the main text of the dAMS-OWSI, but any mitigation carried out where Palaeolithic remains are expected this must include a Palaeolithic and geoarchaeological specialist.

Unexpected finds

- C.1.9 The process for dealing with unexpected finds are set out in paragraphs 7.1.14 and 7.1.15 of the main text of the dAMS-OWSI, and this will apply to the Palaeolithic mitigation.

C.2 Communication, monitoring and sign-off

Communication

- C.2.1 On a Project of this size, effective communication between all parties is essential. A communication strategy for external communications about the Palaeolithic mitigation will be developed and implemented.
- C.2.2 The details of communication between the parties involved is set out in paragraphs 7.2.2 to 7.2.6 of the main text of the dAMS-OWSI, and these will apply to the Palaeolithic mitigation.
- C.2.3 Where Palaeolithic mitigation occurs, the relevant Historic England Regional Science Advisor will be included in any meeting referred to in paragraphs 7.2.2 to 7.2.6 of the main text of the dAMS-OWSI.

Monitoring

- C.2.4 The monitoring processes for the mitigation of the Project are set out in paragraphs 7.2.7 to 7.2.18 of the main text of the dAMS-OWSI, and these will apply to the Palaeolithic mitigation.
- C.2.5 Where Palaeolithic mitigation occurs, the relevant Historic England Regional Science Advisor will be included in any meeting referred to in paragraphs 7.2.7 to 7.2.18 of the main text of the dAMS-OWSI.

Site sign-off

- C.2.6 The sign-off processes for the mitigation of the Project are set out in paragraphs 7.2.19 to 7.2.24 of the main text of the dAMS-OWSI, and these will apply to the Palaeolithic mitigation.
- C.2.7 Where Palaeolithic mitigation occurs, the relevant Historic England Regional Science Advisor will be included in any meeting referred to in paragraphs 7.2.19 to 7.2.23 of the main text of the dAMS-OWSI.

Interim Statements, post-excavation reporting and publication

- C.2.8 The process around monitoring and sign-off of Interim Statements, post-excavation reporting and publication are set out in paragraphs 7.2.25 to 7.2.27 of the main text of the dAMS-OWSI, and these will apply to the Palaeolithic mitigation.
- C.2.9 Where Palaeolithic mitigation occurs, the relevant Historic England Regional Science Advisor will be included in any meeting referred to in paragraphs 7.2.25 to 7.2.27 of the main text of the dAMS-OWSI.

C.3 Methodology for each technique

- C.3.1 The various techniques that could be used for the Palaeolithic mitigation are set out below. This should be considered in association with Table 3.1 and Sections 6.4 and 7.3 of the main text of the dAMS-OWSI.

Geophysical survey

Electrical resistance tomography (ERT)

- C.3.2 Electrical resistance tomography (ERT) will be used to collect data on the buried geology by measuring the electrical resistance of the buried units. Electrical properties are among the most useful geophysical parameters in characterising earth materials. Variations in electrical resistivity (or conductivity) typically correlate with variations in lithology, water saturation, fluid conductivity, porosity and permeability. Depending on the particular site, these variations may be used to map stratigraphic units, geological structure, sinkholes, fractures, and groundwater.
- C.3.3 An IRIS Syscal Resistivity System (80 channel) & Field Computer or similar system will be used to collect the data. The tomography system comprises a number of electrodes linked together via multi-core cables, a switch-box that facilitates access to any combinations of electrodes, a power source and a measuring unit. Resistivity data should be recorded via complex combinations of current and potential electrode pairs to build up a pseudo cross-section of apparent resistivity beneath the survey line. The depth of investigation depends

on the electrode separation and geometry, with greater electrode separations yielding bulk resistivity measurements to greater depths.

C.3.4 Electrodes should be deployed along selected traverse lines and inserted into the ground to a depth of approximately 15cm. If ground penetration is difficult or prohibited, electrodes may be inserted into pre-drilled holes, or placed into surface-mounted clay lumps. If there is poor electrical contact, the electrodes are soaked with a saline solution.

C.3.5 Typically, electrodes will be spaced at 5m intervals to extract maximum depth penetration. Reducing the spacing will reduce the depth coverage but increase the resolution in the near-surface zone. Electrode spacing will be determined on a site-by-site basis. For the survey, a modified Wenner array is likely to be used. This can be supplemented at near-surface by dipole-dipole type measurements and at depth by Wenner-Schlumberger measurements for greater detail.

Electro-magnetic (EM)

C.3.6 The EM survey should be conducted using a Geonics EM 31 or preferably a CMD Explorer or similar. The CMD Explorer has a multi-receiver coil, EM conductivity instrument. Surveys should be conducted in vertical dipole mode (receiver coils at 1.48m, 2.82m and 4.49m from the transmitter are used). This equates to effective depth penetrations of 2.3m, 4.2m and 6.7m respectively. In Phase (magnetic susceptibility) and Quadrature Phase (conductivity) readings from all three dipoles should also be recorded simultaneously.

C.3.7 Ground conductivity is a function of the electrical conductivity of the material (soil or rock), the fluid content and the thickness or depth of individual layers within the ground. Electro-magnetic survey maps geologic variations and subsurface features associated with the changes in ground conductivity without the need for electrodes or ground contact. Ground conductivity measurements will be read directly from an integrated data logger. The instrument should be directly connected to a differential GPS for real-time recovery of spatial positioning data.

C.3.8 Survey areas should be walked as transects across the field at line spacings no more than 20m for landscape survey. Data is collected automatically by the equipment. No electrodes or other probes are placed in the ground. Survey should be conducted in blocks reflecting the pattern of the site boundary and field boundaries. Results should be presented as contour plots of conductivity below ground level at the three depths recorded. These will be provided as raw data and contoured results overlaid on the site map.

Seismic reflection

- C.3.9 Seismic reflection involves inducing a seismic wave into the ground and recording the waves that are reflected from sub-surface layers. While traditionally used for deep geological interpretation, the acquisition and processing parameters can be adjusted to provide a higher resolution at a shallower depth.
- C.3.10 Seismic reflection will only be used in conjunction with deeper test pits.

Boreholes

Cable-percussion and rotary coring

- C.3.11 The layout and number of boreholes will be in accordance with the relevant SSWSI. Boreholes may on occasion need to be slightly moved at the discretion of the on-site field supervisor and Palaeolithic specialist to avoid post-Palaeolithic remains or for other circumstances such as the presence of services or features such as trees, overhead cables, etc. The type of drilling to be used will be selected on a site-by-site basis depending on anticipated ground conditions. It is possible other forms of drilling (e.g. Mostap sampling, Cone Penetration Testing) may be required in particular instances and these will be considered on a site-by-site basis, identified in the Part 2 specification.
- C.3.12 Drilling will be carried out by an experienced contractor under the primary supervision of the drilling operative as advised by the Archaeological Contractor with the Palaeolithic/Quaternary specialists, or an agreed other archaeologist, also in attendance.
- C.3.13 Boreholes will be drilled to a depth agreed with the relevant Local Authority Archaeological Advisor and the Historic England Regional Science Advisor. Ideally, this will span the full depth of Quaternary deposits at the borehole location, proving the underlying pre-Quaternary geology to a depth of at least 1m. The first 1.2m, or other depth based on an assessment of the ground conditions by a competent person, at each borehole location will be hand-dug to verify that natural sediments are present and there is no risk of encountering services, and the revealed sequence in this inspection pit will be logged, and where necessary, sampled. If significant archaeology is encountered within the starter pit, excavation will cease, the exposed features or deposits carefully cleaned and recorded, and the relevant Local Authority Archaeological Advisor and the Historic England Regional Science Advisor informed. To minimise the risk of contaminating groundwater, no drilling will take place within any area of standing water. If required, the starter pit will be supported, stepped or battered as appropriate. To avoid contamination or collapse, all cable percussion holes should be cased as they progress.

- C.3.14 Regular, accurate depth measurement should be made by the driller and communicated to the Palaeolithic/Quaternary specialist. These should be made whenever arisings are logged and sampled, and at each recorded interface between two sedimentary deposits. The log should include details of deposit colour, matrix, coarse component descriptions (clast size-range, degree of angularity roundedness, material and percentage of deposits) as well as any observed sedimentary structures. A series of working shots will also be maintained during the course of the fieldwork.
- C.3.15 Subsequent drilling methodology will depend on the nature of the deposits encountered and the drilling method used. Where deposits containing gravels within otherwise cohesive sediments, of low archaeological potential, are encountered, a cutting shoe may be most appropriate to use; this will provide bulk samples which should be logged and retained where appropriate at 0.25–0.5m intervals. In coarse gravels, a shell bailer may be used; these can similarly be logged and sub-sampled at agreed intervals (e.g. 0.25–0.5m). Alternatively, rotary coring, taking 1.5m cores through the gravels, may be used if fine-grained organic bands are anticipated within the gravel.
- C.3.16 Where fine-grained deposits with apparent or demonstrated palaeoenvironmental or archaeological potential are encountered, sealed U100 samples should be taken with a cable percussion rig (45cm long with a further 0.1m long bulk sample from the cutter attachment) or 1.5m long cores with a rotary rig should be taken. The sample sleeving liners should be light-tight, such as black plastic.
- C.3.17 Logs should be made on the basis of the observed sediments in either of the cores and the bulk sample. The cores should be carefully labelled, indicating the uppermost end of the core. Where continuous samples are to be taken, extra care must be given during the subsequent cleaning phase not to over-cut into undisturbed sediments. Sleeves will be labelled appropriately and handled with care, voids will be packed, splits taped, and cores will be stacked and carried horizontally.
- C.3.18 Where agreed, tubes should be opened off-site immediately after field work to provide detailed logs of their contents. In certain circumstances, under instruction from the Palaeolithic/geo-archaeological specialist(s), this should be done under red-light conditions to preserve optically stimulated luminescence (OSL) dating potential. Photographs of the cores will be taken, using an appropriate scale with 1cm scale divisions and with a board or other label giving the sample's unique number.
- C.3.19 Any archaeological and/or faunal remains encountered will be recovered and recorded as small finds.

- C.3.20 Voids left by sampling will be backfilled to the client/landowner's requirements. Where required, a bentonite grout will be used to fill the void left through augering. Otherwise, clean material will be used to backfill the void left by the sampling to ground level.

Dynamic (windowless) sampling

- C.3.21 The layout and number of windowless samples will be in accordance with the SSWSI. Windowless sample locations may on occasion need to be slightly moved at the discretion of the on-site field supervisor and Palaeolithic specialist to avoid post-Palaeolithic remains or for other circumstances such as the presence of services or features such as trees, overhead cables, etc.
- C.3.22 Windowless sample locations will be laid out initially following the locations previously determined, and the National Grid Reference and ground-surface height accurately located with a differential GPS system or total station. Augering will not take place where there is a risk of contaminating groundwater.
- C.3.23 Windowless sampling will be carried out by an experienced contractor using a tracked Terrier (or Premier) rig under primary supervision of the Contractor with the Palaeolithic/Quaternary geo-archaeological specialists also in attendance.
- C.3.24 Windowless samples will be taken to 6m deep, unless otherwise specified, or unless the borehole fails at a shallower depth. The first metre at each window sample location will be hand-dug to verify that natural sediments are present and there is no risk of encountering services, and the revealed sequence logged. If significant archaeology is encountered within the starter pit, excavation will cease, the exposed features or deposits carefully cleaned and recorded, and the relevant Local Authority Archaeological Advisor and the Historic England Regional Science Advisor informed. The subsequent 5m will be recovered as 5 x 1m plastic tubes.
- C.3.25 Guidance will then be taken on-site from the Palaeolithic/Quaternary geoarchaeological specialists as to whether the tubes should be opened, logged, and (if thought necessary) sampled immediately, or whether they should be retained for off-site sampling. Cores will normally be split open immediately on-site, cleaned, digitally photographed and logged by the Palaeolithic/Quaternary geoarchaeological specialists following standard sedimentary recording procedures. In some circumstances, when the recovered cores have high potential for OSL dating, they will need to be retained unopened, and transported to an off-site laboratory for opening, logging and sampling under red-light conditions.
- C.3.26 When the cores are split and logged on site, unwanted material from the core should usually be disposed of back down the drilled borehole, before topping up any remaining void with sterile bentonite, and other spoil from the inspection pit.

- C.3.27 Photographs of windowless samples will include one image with all five 1m tubes aligned parallel with a hand-tape (or other tape), with 1cm scale divisions laid along the length of the tubes with 0 at the top of the sediment sequence, with the top of each tube facing in the same direction, and with a board or other label giving the site-code and windowless sample unique identifier. Close-up views should also be taken of important sedimentary features and junctions.
- C.3.28 Any archaeological and/or faunal remains encountered will be recovered, and recorded as finds. Samples may also be taken to be evaluated for palaeoenvironmental biological remains, if thought appropriate.
- C.3.29 The ground surface at all window sample locations will be independently surveyed, and tied in with the Ordnance Survey Grid and Ordnance Datum with horizontal and vertical accuracy of $\pm 2\text{cm}$, or more accurate.
- C.3.30 Voids left by sampling will be backfilled to the client/landowner's requirements. Where required, a bentonite grout will be used to fill the void left through augering. Otherwise, clean material will be used to backfill the void left by the sampling to ground level.

Test pits, stepped trenches and deep excavations

Test pits and stepped trenches

- C.3.31 Where deposits with Palaeolithic potential occur within 5m of the surface, a programme of trenching and test pitting will be carried out, both informed and augmented by coring and boreholes.
- C.3.32 These will follow the principles set out in the relevant sections of the main text of the dAMS-OWSI.

Deep excavations

- C.3.33 Four areas have been identified where there is a high potential for survival of Palaeolithic land surfaces and other significant deposits surviving below 5m:
- The area to the north of the South Portal
 - Between the North Portal and Low Lane
 - To the west of North Road
 - The North Ockendon Channel around the M25
- C.3.34 Where there is a high potential for survival of Palaeolithic land surfaces and other significant deposits below 5m, a two-stage approach to mitigation will be adopted.
- C.3.35 The first stage will include the excavation of test pits a minimum of 10m x 10m to the depth to which the Project has potential to impact the deposits. This will

be a substantial excavation requiring protection of the walls of the trench to allow a safe working area at depth. All archaeological and palaeoenvironmental deposits will need to be excavated and recorded and a detailed sampling strategy for scientific analysis and dating developed and revised during the excavation. Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.

- C.3.36 The second stage is an iterative development of the first stage, with further works determined by the outcomes of the first stage. The second stage could include further excavation at depth, additional sampling and analysis of deposits, or a process for the sampling of bulk material and retrieval of any archaeological or palaeoenvironmental material.
- C.3.37 The deep excavations are to be machine and hand excavated to a maximum depth of c. 10–12m with a width of 10m. They will be sheet piled and braced (hydraulic prop bracing) or similar. Detailed method statements will be prepared with the Principal Contractors, archaeological contractors, relevant local authority archaeological advisors and the relevant Historic England Regional Science Advisor. Sections for geoarchaeological recording and scientific sampling will be maintained during excavation.
- C.3.38 Each test pit will be dug by hand and, where appropriate, mechanical excavator with a toothless bucket between 1.25m and 2m width, unless otherwise agreed. No excavation shall take place below the impact of the Project and will cease at a shallower depth if pre-Quaternary deposits have been reached. Each test pit will be taken down in horizontally in spits maintaining running sections if warranted for recording and sampling. The work will be directed by the Palaeolithic/geo-archaeological specialist(s).
- C.3.39 The extent of archaeological work will be determined by the Palaeolithic/geo-archaeological specialist(s) following the consultation process set out in the main document. It will include, but not be limited to:
- a. sequence-logging (and/or section-drawing) and sediment description
 - b. on-site sieve-sampling
 - c. palaeoenvironmental sampling
 - d. finds recovery
 - e. sampling for dating
- C.3.40 Any post-Palaeolithic archaeology will be dealt with in accordance with the proposals in the main document and Annex B.

- C.3.41 Alongside the SSWSI, a detailed method statement needs to be developed with the relevant Principal Contractor to ensure the works meet the aims and objectives of the SSWSI.

On site sieve-sampling

- C.3.42 When deposits of interest are encountered (as identified by the Palaeolithic/geoarchaeological specialist) spit-samples of at least 150 litres will be set aside at regular c. 25cm intervals as excavation progresses. Each sample will be given a unique number, and its position in the stratigraphic sequence recorded. At least 100 litres from each spit-sample will be dry-sieved on site through a c. 1cm mesh for recovery of lithic artefacts and faunal remains. If the sediment encountered is not suitable for dry-sieving (i.e. too clayey), excavation will proceed in shallower spits of c. 5cm, looking carefully for the presence of any archaeological evidence, and the spit samples will also be carefully investigated by hand for any archaeological evidence. The remainder of the spit-sample may be sampled for palaeoenvironmental biological remains or clast lithology, if appropriate.

Sequence-logging, section-recording and sediment description

- C.3.43 Sedimentary sequences should be logged from the top of the sequence downward (usually, but not always, down from the ground surface). Logged sequences should be tied in with a GPS-surveyed datum point. If a deposit sequence is distributed across more than one vertical stretch, such as in the section of a stepped trench, then separate datum tie-in points need to be recorded for each separate vertical stretch.
- C.3.44 Different beds within deposit sequences should be defined and labelled by the Palaeolithic/geo-archaeological specialist, with (for machine-dug test pits and stepped trenches) a unique number based on the intervention label. For recording borehole sequences from cable-percussion boreholes and dynamic (windowless) sampling, sediment recording should be based on the depth-range from the top of the borehole. Thus, specific beds from borehole sequences will be defined by the borehole UID and a depth-range.
- C.3.45 For each defined bed, the textural characteristics (grain-size, consolidation, colour, material and sedimentary structures) of sedimentary units will be recorded, and the shape and nature of their lithostratigraphic contacts (dip, conformity and overall geometry).
- C.3.46 A representative section from each test pit will be drawn at a scale of 1:20 and photographed in colour (digital) once excavation has reached its full depth, and at appropriate stages in the course of excavation if features of interest are revealed. Other sections will also be drawn and/or photographed as appropriate, particularly where more complex stratigraphy is encountered. A

series of working photos will also be maintained during the course of the fieldwork.

- C.3.47 Sections will typically be drawn at a scale of 1:20, although can also be drawn at 1:10 or 1:50 if appropriate. All section drawings will include a horizontal datum line, with both ends (and intervening points along the line if appropriate) tied in with the OS Grid to 0.01m accuracy, and with its height above Ordnance Datum surveyed to the same level of accuracy. All sections are to be drawn in pencil on polyester-based drafting film and clearly labelled.

Environmental sampling strategy

- C.3.48 The presence/potential for palaeo-environmental micro-biological evidence such as pollen, insects, molluscs and small vertebrates will be assessed for each sediment unit by field inspection by the Palaeolithic/geo-archaeological specialist. They will consider the potential of the sediments encountered, and guide sampling as appropriate (including specifying any special needs for off-site processing methods).
- C.3.49 Innovative methods for supplementing palaeoenvironmental data should be considered. These include sediment geochemistry and sedimentary DNA investigations. These represent novel approaches in geoarchaeology in the Thames. Core scanning of borehole cores or test pit monoliths can be undertaken prior to sampling for other proxy records. Sediment DNA analysis will require detailed consideration due to the need to store samples in a cold store and cut/record/sub-sample sediments for DNA in clean laboratory environments. The advice of a relevant laboratory should be sought prior to any fieldwork taking place if sedimentary DNA investigation is to be undertaken in the project.
- C.3.50 Provision should be built into the reporting programme for processing any samples taken and reporting on the results of each stage of the mitigation.
- C.3.51 All samples taken will be given a unique numeric ID number, tied in with the fieldwork site-code. Those from test pits and standing sections will be given a sediment provenance based on the numeric deposit context. Samples from boreholes will be given a provenance based on depth-range, rather than a context number.

Scientific dating strategy

Principles and strategy

- C.3.52 Establishing the date/period of any Quaternary deposits encountered is generally one of the key specific objectives of any fieldwork package. However, there may on rare occasions be instances when the general date is already well-understood from previous work, so additional investigations may not be necessary. Therefore, it is necessary during fieldwork to always consider

whether any deposits, or other evidence, are encountered with potential to provide dating results using any of the available methods for dating deposits in the range from <10ka [thousand years ago] down to c. 500ka, which is approximately the timespan for Quaternary sediments likely to be encountered in course of the Project.

- C.3.53 A range of chronometric dating methods are potentially applicable in this time-range, some of these (such as OSL, see below) rely on scientific analysis of the sediment itself. Others (such as amino acid racemisation (AAR) dating, see below) rely on analysis of mollusc remains found within the sediment. Dating can also be achieved by non-chronometric means, such as biostratigraphy or stratigraphic correlation.
- C.3.54 If any deposits with dating potential are encountered, or with the potential to contain remains with dating potential, it is necessary that they be sampled and/or studied with techniques that will allow their dating potential to be realised. This needs to be done under guidance of the Palaeolithic/geo-archaeological specialists.
- C.3.55 A brief outline of some of the main approaches to dating that are likely to be applicable in the fieldwork for the Project is provided below. The approach is not limited to these techniques and other more innovative techniques such as tephra dating will be considered.

Optically stimulated luminescence (OSL) dating

- C.3.56 This dating technique is applied to buried sand-grains, and thus is widely applicable to Quaternary sediments. The basis of the technique is that, when analysed in a suitable laboratory, the sand-grain gives off a different amount of light (luminescence) from a controlled degree of heating (optical stimulation), according to how long it has been buried. Thus, based on an accompanying measurement of the background radiation in the sampled sediment, the amount of measured luminescence acts as a 'clock' for burial duration.
- C.3.57 The 'clock' is reset to zero by exposure to daylight, so samples in the field need to be taken in light-proof casings, typically a plastic or metal tube hammered into a standing section. These always need to be accompanied by a double-bagged sediment sample of c. 20cm³, to establish the sediment's moisture content. However, samples can also be recovered from borehole tubes.
- C.3.58 The technique works best when samples are taken from a sand-dominated bed at least 50cm thick, with the sample location being at least 25cm from the junction with any other deposits. If a thick sand-dominant bed is being sampled, there is no benefit in supporting the samples with *in situ* gamma dosimetry readings, which need to be carried out by an OSL specialist (or other suitably trained specialist) with specialist equipment. However, samples from thinner beds need to be supported by *in situ* gamma dosimetry readings, carried out on

site by a suitably trained specialist. It has also been attempted to sample sand from gravel-rich deposits, although this requires attempted construction of a light-proof tent in the field against the section being sampled, and no convincing results have been obtained from this approach.

- C.3.59 OSL dating samples should always be taken in a vertical series through a sediment body, with samples from the top, middle and bottom of a deposit if the bed is thick enough. Additional samples from other beds through a sequence should also be taken wherever possible. Consideration should be given to the field logging of luminescence stratigraphy from proxy luminescence data generated with portable OSL equipment in order to better understand sequence accumulation and guide the most appropriate location for OSL sampling in the field. When it comes to deciding which samples to process, it is necessary to ensure results are obtained from throughout the sampled sequence. Bayesian statistical techniques can then be used to narrow their accuracy, and rogue results can also be weeded out.
- C.3.60 The technique is very suitable for answering big-picture dating questions such as whether a sandy bed is modern, Holocene or Pleistocene. As with all techniques, its accuracy diminishes for older deposits. Its accuracy is probably in the range of 5-15% for deposits less than 100,000BP, and then diminishes to 15-25% for older deposits, with the useful ceiling of the technique being about 300,000BP. The big problem with application of OSL is that rogue results are relatively common (established from instances where other reliable dating techniques have been applied alongside OSL, or where OSL has been applied to sediments whose age is confidently known for other reasons). If, as is often the case, OSL is the only possible approach to dating a sediment body, one never knows how much to rely on the result, especially if it conflicts with prior expectations, although pre-sampling use of proxy-luminescence profiling can significantly improve reliability of results and reduce the chances of rogue results. Therefore, when carrying out an analysis programme on OSL samples, guidance needs to be taken from the Palaeolithic/geo-archaeological specialists on: (a) the specific dating objectives of analysis, (b) selection of samples for analysis, and then (c) interpretation of the results.

Carbon-14 (C14) dating

- C.3.61 This is a very robust and accurate technique, applicable to organic remains such as wood, bone, and shell. From the point of view of Palaeolithic/Quaternary investigations, its problems are: (a) that these suitable materials are rarely found, and (b) that the useful dating ceiling of the technique (c. 40,000BP) is often too young to be useful, as deposits under investigation are often much older.
- C.3.62 However, in the specific context of the Project, the early post-Last-Glacial colonisation in the Lower Thames basin and the Late Upper Palaeolithic to

Mesolithic transition has been identified as a research theme. Evidence for this is likely to be found under the widespread and deep alluvial deposits either side of the Thames, and these are likely to provide good preservation of these organic materials.

- C.3.63 Seeking these sites at the base of the alluvium, and then recovering suitable material for C14 dating from (a) horizons of Late Upper Palaeolithic and Mesolithic activity, and (b) overlying and underlying horizons, should be a priority for the Palaeolithic archaeological work.

Amino acid racemisation (AAR) dating

- C.3.64 Amino acid racemisation (AAR) is a chronometric dating technique that is most applicable to mollusc shells (and in particular *Bithynia opercula*), although current advances are expanding the technique to other faunal remains such as mammal teeth, bones and earthworm granules. The technique is very robust and with good precision at Middle and Late Pleistocene timescales, between 50,000 and 500,000BP, and so is particularly useful for UK Palaeolithic/Quaternary investigations.
- C.3.65 In general, while avoiding unnecessary duplication, AAR should be applied whenever the opportunity arises. The main problem is that the small faunal remains on which the technique is typically applied will not be directly identifiable during fieldwork, but will only be discovered after assessment of palaeoenvironmental samples. Therefore, it will be necessary to take samples blind from any potentially suitable sediments encountered, and then process and pick the samples in the hope of finding suitable remains.
- C.3.66 Samples from which material for AAR might be recovered (which is all bulk samples taken for the Palaeolithic programme) need to be processed as specified in the relevant method statement, using gentle pressure from cool water, dried at room temperature out of direct sunlight, and without use of any chemical decoagulants.
- C.3.67 When suitable remains are found, at least eight individual specimens should be sent for analysis from each sample to achieve a statistically valid spread of data, to derive a good dating result for comparison with other AAR results from other sites.

C.4 Reporting, publication and dissemination

- C.4.1 Reporting, publication and dissemination of the Palaeolithic mitigation will follow the processes set out in paragraphs 8.1.1 to 8.7.1 of the main text of the dAMS-OWSI.

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Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

National Highways Limited registered in England and Wales number 09346363