

Technical Standard - Specification for historic environment investigations

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List of acronyms

AIMS	Asset Information Management System
BIM	Building Information Modelling
CAD	Computer-Aided Design
CAT	Computed Axial Tomography
CDM	Construction (Design and Management)
CIfA	Chartered Institute for Archaeologists
CoCP	Code of Construction Practice
DAS	Deliverable approach statement
DDBA	Detailed Desk Based Assessment
EIA	Environmental Impact Assessment
EIR	Environmental Information Request
EMR	Environmental Minimum Requirement
ES	Environmental Statement
ETR	Electrical Resistance Tomography
FOI	Freedom of Information

GLAAS	Greater London Archaeology Advisory Service
GIS	Geographical Information Systems
GNSS	Global Navigation Satellite System
GPR	Ground Penetrating Radar
GWSI: HERDS Strategy	Generic Written Scheme of Investigation: Historic Environment Research and Delivery Strategy
HE	Historic England (formerly English Heritage)
HER	Historic Environment Record
LLAU	Limits of Land to be Acquired or Used
LOD	Limit of Deviation
LS-WSI	Location Specific Written Scheme of Investigation
OASIS	Online Access to the Index of archaeological investigations
PDF	Portable Document Format
PGM	Permanent Ground Markers
QA	Quality Assurance
RICS	Royal Institute of Chartered Surveyors
RTK	Real Time Kinematic
TBM	Temporary Bench Mark
TSA	The Survey Association
TST	Total Station Theodolite

Conventions

Mandatory clauses

The following convention is used to indicate mandatory clauses.

Mandatory clauses are differentiated from the main text of this document by use of a 'black box'. They contain the word 'shall' to indicate their status as a requirement.

Departures

Any intention to not comply with a mandatory clause is considered to be a departure from this Technical Standard.

It is recommended that the designer discusses any proposed departures with HS2's Technical Directorate at an early stage.

Guidance

The following convention is used to indicate guidance.

NOTE – Guidance is differentiated from the paragraph to which it relates by use of italic type and use of the words "should" or "may".

1 Introduction

- 1.1.1 The specification for historic environment investigation has been prepared in accordance with and in support of the *Generic Written Scheme of Investigation: Historic Environment Research and Delivery Strategy (GWSI: HERDS)* (HS2-HS2-EV-STR-000-000015).

1.2 Purpose

- 1.2.1 The purpose of this Technical Standard is to provide a consistent approach to historic environment investigation across Phase One of HS2. It sets out the standards and minimum requirements for each type of investigation to be undertaken as part of the programme of historic environment works.

1.3 How to use this document

- 1.3.1 This Technical Standard should be used in conjunction with the *Specification for Project Plans and Location Specific Written Scheme of Investigations* (LS-WSIs) - HS2-HS2-EV-STD-000-000036.

- 1.3.2 Text from sections 3 and 4 of this Technical Standard shall be adapted or copied into the Project Plan / LS-WSI in order to suit the specific location. It is the responsibility of the Contractor producing the Project Plan and LS-WSI to ensure that each Project Plan and LS-WSI is tailored to the specific requirements of each location whilst following the methodologies and guidance set out in this specification.

- 1.3.3 This Technical Standard is set out as follows:

- Section 2 - standards which are applicable to all Historic Environment investigations;
- Sections 3 and 4 - specialist methodologies for Historic Environment investigation; and

2 Standards for all historic environment investigations

- 2.1.1 The complete list of HS2 Phase One Historic Environment technical standards is set out in Appendix B. This section provides the additional technical standards required for the *Contractor* to undertake historic environment investigations. It does not outline all technical standards applicable to works undertaken on behalf of the *Employer*.

- 2.1.2 The *Contractor* shall undertake historic environment investigations in accordance with the technical standards in section 2.2 and Appendix B.

2.2 Compliance to HS2 technical standards

Written Scheme of Investigation: Historic Environment Research and Delivery Strategy

- 2.2.1 The GWSI: HERDS is the lead document for the specification and delivery of historic environment works associated with Phase One of HS2.
- 2.2.2 All historic environment works should be in accordance with the HS2 Generic Written Scheme of investigation: Historic Environment Research and Delivery Strategy (GWSI: HERDS) – HS2-HS2-EV-STR-000-000015.

Departures

- 2.2.3 In the event that a variation on a methodological approach is proposed, the departures procedure set out in GWSI: HERDS should be followed.

Temporary works

- 2.2.4 The *Contractor* shall be responsible for temporary works required to facilitate historic environment investigation. All temporary works should be in accordance with the Technical Standard – Temporary Works (HS2-HS2-CV-STD-000-000005).
- 2.2.5 This standard covers the subject of the design and construction of temporary works.

Intrusive archaeological investigation

- 2.2.6 Intrusive archaeological investigations will comply with the Technical Standard - Soil handling for Land Restoration (HS2-HS2-EV-STD-000-000008).
- 2.2.7 This technical standard describes how soil resources displaced both temporarily and permanently by HS2 works shall be conserved and subsequently used for the reinstatement of agricultural land, landscape planting and ecological habitat creation. It also sets out the provisions that shall be made to facilitate the maintenance of farm and other land-based rural enterprise infrastructure, including access to land holdings.

Event Data

- 2.2.8 Historic Environment Investigations will comply with the document Asset Information Management Plan (HS2-HS2-IM-PLN-000-000005). This supports the entire asset lifecycle, through design, construction, testing and maintenance.
- 2.2.9 The Asset Information Management (AIM) plan sets out the framework to ensure good practice with regard to asset information management and delivery of the *Employer's* AIM Strategy. This is critical to the delivery of the HS2 Building Information Management (& Modelling) Strategy; the Archaeology Asset Data Dictionary Definition document (HS2-HS2-IM-ADD-000-000017) provides further detailed information.

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| 2.2.10 | As part of compliance with the AIM, the location of all types and material classes of artefacts recovered during the course of all field investigations and the date that they were recovered, shall be recorded. |
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2.2.11 This is to enable, where required, artefacts to be returned to specific landowners.

Generic Standards

2.2.12 All works affecting heritage assets undertaken in connection with Phase One of HS2 shall be carried out by suitably qualified, experienced and competent individual professionals and organisations. The *Employer* requires all such works undertaken to have appropriate regard to accepted industry practice, national guidelines and codes of practice appropriate to the project; this includes publications by Historic England, the Chartered Institute for Archaeologists and the Institute for Historic Building Conservation.

2.2.13 Historic Environment works shall be undertaken in accordance with standards and guidance set out in the GWSI: HERDS and, where relevant and practicable, shall reflect other industry practice guidance (including subsequent revisions and updates) e.g.:

- Archaeology Data Service. Archaeology Data Service/Digital Antiquity guides to good practice.
- Chartered Institute for Archaeologists (2014) Code of Conduct.
- Chartered Institute for Archaeologists (2014) Standard and Guidance: For the collection, documentation, conservation and research of archaeological materials.
- Chartered Institute for Archaeologists (2014) Standard and guidance: archaeological watching brief.
- Chartered Institute for Archaeologists (2014) Standard and guidance: archaeological excavation.
- Chartered Institute for Archaeologists (2014) Standard and Guidance: Archaeological field evaluation
- Chartered Institute for Archaeologist's (2014) Standard and guidance: For the archaeological investigation and recording of standing buildings or structures.
- English Heritage(2008) Conservation Principles, policies and guidance for the sustainable management of the historic environment.
- English Heritage(2011) Environmental Archaeology: A guide to the Theory and Practice of Methods, from Sampling and Recovery to post-excavation (second edition).
- Historic England(2015) Geoarchaeology: Using earth sciences to understand the archaeological record.
- Historic England(2015) Management of research projects in the historic environment (and associated guides and project planning notes).

Communication and engagement

2.2.14 In undertaking historic environment investigation, the *Contractor* shall seek relevant knowledge and advice from national and local stakeholders and expert bodies through the mechanisms defined in the GWSI: HERDS.

2.2.15 Key stakeholders are likely to be:

- Historic England;
- relevant local authority archaeologists (GLAAS, Buckinghamshire, Hertfordshire, Oxfordshire, Northamptonshire, Warwickshire, Staffordshire and Birmingham);
- relevant local authority conservation officers;
- relevant local interest groups; and
- relevant and acknowledged specialists in such fields as geophysical survey and archaeological science (most likely employed by contracting archaeological companies or university departments).

2.2.16 Communication and engagement with third parties shall use the *Employer's* communication protocols set out in the *Employer's* Community Relations Strategy and HS2 Ltd. Community Engagement Framework (HS2-HS2-SE-STR-000-000002).

GIS/BIM requirements

2.2.17 Historic environment investigations shall adhere to a standard approach to GIS deliverables that is set out in the *Employer's* Cultural Heritage GIS Specification (HS2-HS2-GI-SPE-000-000004). The *Employer's* standard templates for reports and maps will be used. Mapping and spatial data deliverables will conform to a standard approach to ensure consistency across all the contracts.

2.2.18 All data shall comply with the *Employer's* GIS Standards as set out in HS2-HS2-GI-STD-000-000002 and other associated referenced documents.

3 Methodology for Detailed Desk Based Assessment

3.1 Introduction

3.1.1 Should the need for Detailed Desk Based Assessment (DDBA) be identified in accordance with the GWSI: HERDS objectives and requirements of the design, the *Contractor* shall follow the methodology set out in section 3.

3.2 Objectives

- 3.2.1 The DDBA will build upon the information gathered previously in the HS2 Phase One Environmental Statement to address particular issues, questions or uncertainties within a given area. It may be developed to provide a more detailed understanding of the resource in an area to inform design development or construction programming. It may also be prepared to develop a more nuanced and detailed understanding of questions relating to Specific Objectives in the GWSI: HERDS.
- 3.2.2 For example, a DDBA may be developed to:
- Support the identification of the likely geographical extent of archaeological complexes such as deserted medieval settlements;
 - Support the assessment of the likely depth, extent and character of archaeological remains in urban and rural areas;
 - Provide further information on the scale of historic ground disturbance in an area e.g. within urban areas or areas where extraction previously occurred;
 - Provide greater detail on the development of post-medieval and medieval field systems in an area to contextualise other archaeological works;
 - Provide detail on the form, development and alteration of designed landscapes including for example medieval deer parks; or
 - Provide further information about the likely archaeological character of an area including identifying, where possible, the survival and condition of remains.
- 3.2.3 In all cases there will be a set of clearly defined objectives / reasons for the development of a Detailed Desk Based Assessment. These will be set out and clarified in the Project Plan for each DDBA.
- 3.2.4 All DDBAs shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 3.2.5 In all cases the DDBA will:
- assess the significance of any identified and surviving remains or assets;
 - assess the extent of identified and potentially surviving remains;
 - assess the change to the significance of the identified heritage assets as a result of the detailed design; and
 - suggest measures, if appropriate and feasible, for the conservation of identified significant assets.
- 3.2.6 The DDBA can serve as a design document to inform project decisions based on the potential impact to heritage assets. In these circumstances assessment of the extent, depth, complexity and character of remains will be critical.
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- 3.2.7 The DDBA will also, where appropriate to the purpose of the DDBA, provide recommendations for further investigation based on the GWSI: HERDS Specific Objectives and project requirements. Details on the methodologies for conservation or investigation at particular locations will be set out in Project Plans and Location Specific Written Scheme of Investigation (LS-WSI).

3.3 Technical Scope

3.3.1	The need and scope of each DDBA shall be identified by the <i>Contractor</i> in line with the GWSI: HERDS objectives and requirements of the design and shall be set out in a Project Plan.
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- 3.3.2 The additional documentary research should use an extensive range of secondary literature and primary sources and new data.

3.4 Sources

Design and engineering

- 3.4.1 The DDBA assessment will be based upon the most current engineering detailed designs and construction information.

Archaeological and historical background

- 3.4.2 The HS2 Phase One Environmental Statement, Supplementary Environmental Statements baseline and the Resource Assessment in the GWSI: HERDS provides a starting point for the DDBA to build upon. Additional research will then be targeted on specific issues relevant to the location.
- 3.4.3 The scope for a DDBA will be set out in a Project Plan. A list of example sources has been provided in
- 3.4.4 Table 1, this is not an exhaustive list but meant as a starting point that will need to be amended and / or expanded as appropriate for the research aims and context of the location. Where appropriate, the results generated by the HS2 Phase One targeted surveys, should also be incorporated into the reporting.

Table 1: Sources for DDBA.

Local heritage	• Local interest groups • Local authority archaeologists • Local authority conservation officers
Historic Environment databases and documents	• Historic environment records • National Heritage List for England (NHLE) • Historic England Archives • National Mapping Programme • Archaeological survey data • Archaeological grey-literature reports • Archaeological journals and monographs • Archaeological data service (ADS) • Regional inventories • Public and private collections • Portable Antiquities Scheme (PAS) • Conservation Area Appraisals and Management Plans • Extensive Urban Surveys • Historic Lands Characterisation datasets and reports
Historical documents	• Charters • Registers • Manuscript collections (secular and ecclesiastical) • Deeds • Wills • Estate papers • Electoral rolls • Contemporary publications • Published inventories e.g. Pevsner
Cartographic and pictorial documents	• Ordnance Survey maps, as detailed scale as possible • Early maps, prints and paintings • Tithe, enclosure and other parish maps • Estate plans
Remote sensing data	• Aerial photographs held at relevant repositories • Lidar data produced by the <i>Employer</i>. • Hyperspectral data produced by HS2 • Lidar data held by Environment Agency (now freely available)

Geotechnical information	• Borehole and test pit logs • Site surveys • Geological maps
Secondary sources	• Regional and period studies • Landscape studies • Regional and National Research Assessments and Strategies

3.5 Spatial scope

- 3.5.1 The spatial scope will vary depending on the location and objectives of the DDBA. The aims and objectives of each DDBA may vary considerably between different locations. It is therefore necessary that the spatial parameters of each DDBA are not standardised but reflect the scope of the research aims and the scale of the works.
- 3.5.2

3.6 Walkover survey

- 3.6.1 Wherever necessary to fulfil the objectives of the particular DDBA, a walkover survey will be undertaken to identify and characterise potential archaeology, extant heritage assets, historic landscape features or built heritage assets; as well as areas of historic and modern ground disturbance. Where required the walkover survey will be undertaken unless precluded by health and safety issues and/or access arrangements.
- 3.6.2 It will take the form of either an archaeological survey or building assessment, or combination of the two.

Archaeological survey

- 3.6.3 The exact objectives for a walkover survey will depend on the reasons for undertaking the DDBA. Generally, the aim of the survey will be to identify and record any previously unrecorded historic assets (including historic landscape features), to analyse the topography and identify potential impacts that may have affected the survival of the resource (such as modern or historic ground disturbance). The immediate surrounds will also be inspected to record any contextual data such as features and earthworks that add additional information to the understanding of the location. Observations will be recorded digitally on plans and survey sheets.
- 3.6.4 Archaeological walkover surveys will be carried out in rural and urban contexts, as such different environments will require a different approach.
- 3.6.5 The main aims of a rural archaeological walkover survey will generally be to:
- identify any known assets;
 - identify any previously unrecorded potential archaeological features, such as

earthworks; and

- identify areas of modern impacts.

3.6.6 Accessibility issues will also be assessed during rural walkover surveys, though these are more likely to be concerned with:

- identification of access routes to site;
- the suitability of ground condition for machines and survey equipment; and
- presence of crop, pasture and livestock.

3.6.7 The main aims of an urban archaeological walkover survey will be to:

- identify areas of modern impacts e.g. floorspace of existing buildings, presence of basements, presence of underground utilities and drainage;
- identify any known assets; and
- identify any previously unrecorded potential features.

3.6.8 Accessibility will be a key concern of urban walkover surveys and will aim to:

- identify access routes to site;
- identify the presence of underground utilities and drainage;
- identify overhead services;
- assess the suitability of the site confines for machines and survey equipment;
- record hazards that might be present that would restrict access, such as asbestos; and
- assess the suitability of access points for machines.

Building survey

3.6.9 Wherever required to meet the aims of a DDBA, a building survey will be undertaken. The aim of these surveys is to provide a basic record in order to characterise the area and identify potential significance in buildings. This will also provide a baseline to inform the need and scope further assessment. The survey will inspect the exterior of the building, its setting, associated structures (e.g. street furniture) and where possible the interior to identify significant features and potential risk. Observations will be recorded digitally on plans/elevations as appropriate and survey sheets.

3.7 Setting

3.7.1 There are a number of locations where HS2 works will have an impact on the setting of heritage assets, as identified in the ES or Supplementary ESs. The need for and extent of a DDBA for assessing the setting of heritage assets (and any subsequent recording

and analysis recommended within the DDBA) will be driven by specific objectives established in the GWSI: HERDS.

- 3.7.2 Further guidance on defining setting, the need for recording setting and the approach to recording setting are set out in the *Technical Standards for Recording the Setting of Heritage Assets* (HS2-HS2-EV-STD-000-000037).

3.8 GIS/BIM requirements

General

- 3.8.1 Historic environment investigations must adhere to a standard approach to GIS deliverables that is set out in the *Employer's Cultural Heritage GIS Specification* (HS2-HS2-GI-SPE-000-000004). The *Employer's* standard templates for reports and maps will be used. Mapping and spatial data deliverables will conform to a standard approach to ensure consistency across all the contracts.

- 3.8.2 All data shall comply with the *Employer's* GIS Standards as set out in HS2-HS2-GI-STD-000-000002 and other associated referenced documents.

Mapping

- 3.8.3 Mapping shall be prepared in accordance with the following:
- All maps will be produced using the formal ES A3 landscape map template document number: HS2-HS2-GI-TEM-000-000016);
 - all maps will have the HS2 logo on the map. Map name and codes are defined below;
 - maps will generally be at 1:10,000 scale. Larger scales will be acceptable if the area is small and the scale would improve;
 - maps will utilise where practicable the symbology for features used in the formal ES. Symbology for new features is to be agreed with the *Employer* in advance of the final submission of maps;
 - maps are to include as standard and where relevant the following features;
 - Construction boundary and the Act alignment (Standard formal ES symbology/terminology).
 - Local Authority district boundaries (Standard formal ES symbology/terminology).
 - Community forum boundaries (Standard formal ES symbology/terminology).
 - 1:10,000 basemapping should be standard OS Vectormap.

- 1:5,000 mapping should be standard OS Mastermap topo lines only (no colour fill); and
- maps will be uploaded into eB when approved.

Spatial Data

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| 3.8.4 | The <i>Contractor</i> shall deliver the following data outputs for DDBAs: |
| 3.8.5 | All data, not previously issued by the <i>Employer</i> , is to be submitted in accordance with the <i>Employer's</i> standards HS2-HS2-GI-STD-000-000002; |
| 3.8.6 | data delivery must include feature classes used for data driven pages; and |
| 3.8.7 | any amendments required to the template schema, should be communicated to the <i>Employer's</i> Spatial Data Management Team, so that it can be updated and re-issued to all contracts. Additional attribute fields added to the template schema, not agreed with the <i>Employer</i> , will result in the data being rejected when submitted. |

- 3.8.8 A copy of the data schema is provided in Appendix A and B of the *Employer's Cultural Heritage GIS Specification* (HS2-HS2-GI-SPE-000-000004).

3.9 DDBA deliverables

- 3.9.1 The two key DDBA deliverables comprise the Project Plan setting out the scope of the DDBA, and the DDBA report itself.

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| 3.9.2 | The <i>Contractor</i> shall structure the DDBAs in accordance with the template set out in section 3.10. |
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- 3.9.3 The content should be appropriate to the scope of the DDBA in accordance with the specific objectives of the GWSI: HERDS as set out in the Project Plan.

- 3.9.4 The results will be presented in order to inform decision-making. Where necessary recommendations, which will feed into the design of further investigation and/or engineering design, will be presented in the DDBA.

3.10 Report structure

Executive Summary

- 3.10.1 One page maximum; this should be a pertinent one page summary using non-technical terminology that includes the location and extent of assessment, scope, aims and objectives, main results and conclusions.

Introduction

- 3.10.2 This will detail the circumstances leading to the works, the specific objectives and reasons for undertaking the DDBA, the nature and extent of the work.

Assumptions and limitations

- 3.10.3 This will detail any restrictions on reporting, access to relevant records or limitations imposed by the current design stage.

Methodology

- 3.10.4 The following interfaces may be required, in order that the DDBA is produced in a fully collaborative environment from the outset:

- construction planners;
- civils and utilities engineers;
- design engineers;
- geotechnical specialists;
- unexploded ordnance specialists;
- ecologists;
- town planners;
- GIS technicians;
- landscape architects; and
- land access co-ordinators.

- 3.10.5 The most pertinent documents to be used during production of the DDBA are listed below. This is not an exhaustive list; refer to the *Specification for Project Plans and Location Specific Written Scheme of Investigations* (LS-WSIs) (HS2-HS2-EV-STD-000-00003) for a more extensive list of relevant documentation.

- Chartered Institute for Archaeologists (2014) *Standard and guidance for historic environment desk-based assessment*;
- Chartered Institute for Archaeologists (2014) *Standard and guidance for the archaeological investigation and recording of standing buildings or structures*;
- Historic England (2016) *Understanding Historic Buildings*;
- Historic England (2015) *The Setting of Heritage Assets*.

- 3.10.6 The methods used for research, interpretation and assessment will all be carefully explained in relation to the stated objectives and reasons for undertaking the DDBA. This will include the research undertaken and sources consulted and any variations to the proposed scope, the methodology for assessing significance of heritage assets, and methodology for understanding the impact of scheme elements of the significance of heritage assets. The methodology will refer back to the Project Plan for the DDBA.

Baseline conditions

- 3.10.7 The baseline section will be informed by the research undertaken as part of the DDBA. The research will be reported in sections under the following headings to a level of detail appropriate to the scope of the location and results of the assessment.
- 3.10.8 Where sections are superfluous to the aims and objectives of the DDBA they should be omitted from the scope.
- 3.10.9 Additional sections may be added where necessary and where specified in the Project Plan.

Site conditions

- 3.10.10 This section should be an interpretive description of the geology and topography of the study area and how it relates to archaeological and/or built heritage potential and the approach of further archaeological investigation.

Walkover survey

- 3.10.11 This section will provide a detailed synthesis of any walkover survey undertaken as part of the DDBA. The data from the walkover survey will be recorded digitally on survey sheets and included as appendices in the DDBA.

Archaeological and historical background

- 3.10.12 The archaeological and historical background will provide a detailed description based on the archaeological and non-archaeological sources of written, graphic, photographic and electronic information. It should avoid repetition of the broad summaries previously reported in the HS2 Phase One Environmental Statement and Supplementary ESs.
- 3.10.13 Where relevant, the background will report the findings of the baseline assessment in chronological order under period headings. Broad period headings should normally be used to describe the archaeological and historical background of each site. Where the data provides sufficient chronological resolution period sub-headings should be used. Likewise if a location has an appreciable association with one century it should be included as a heading, for instance: 19th century (1800 to 1899). A list of date ranges is provided in Appendix A.
- 3.10.14 This section may be amended to reflect the specific objectives of the DDBA. For example, if the DDBA has been developed to address the extent of surviving historic landscape features associated with a former parkland, then the section would focus on the relevant history and development of the park and subsequent changes. A general historic environment background would not be required. The exact scope of the section would be specified in the Project Plan for the DDBA.

Predicted heritage assets

- 3.10.15 Following the archaeological and historical baseline the DDBA will identify the predicted location, extent and date of known and unrecorded heritage assets. This will
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be reported under chronological headings including a short summary that highlights the pertinent archaeological or historical points that identify the predicted assets.

Construction impacts on heritage assets

- 3.10.16 The report will identify all individual elements of the construction of the scheme and identify where there are predicted impacts to heritage assets. It will provide a quantitative assessment of the scheme impact on each heritage asset – this will include levels, depths and dimensions. The impact on the significance of the heritage assets will also be determined where possible. The nature of the impact will be used to inform decisions on the requirements for detailed design and further historic environment investigations.
- 3.10.17 The assessment will consider all aspects of the construction of the design element and not just the spatial extent of the land required for construction. Impacts which will need to be addressed include (be should not be limited to) topsoil stripping, bulk excavation, piling, utility trenches, fencing, construction compound establishment, ground investigation, utility diversions, drainage and balancing ponds, landscaping, ecological mitigation areas and dewatering. Special consideration should be given to the depth of impacts and the predicted depth of heritage assets.

Recommendations and research aims for further investigation

- 3.10.18 This section will provide recommendations to inform the requirement and scope of further evaluation and investigation. All recommendations shall be designed in the specific objectives of the GWSI: HERDS. Where applicable this section should also be used to recommend methods of reducing or mitigating the impacts of the scheme.

References

- 3.10.19 All references will follow the HS2 system of referencing.

Appendices

Figures

- 3.10.20 A series of drawings will accompany the text and will include:
- **General plan:** A location plan(s) mapping locations of identified heritage assets in relation to the site boundary. (mandatory)
 - **Engineering design:** Engineering plan(s) detailing the various construction elements in relation to the site boundary. These should include details of where significant new ground disturbance is expected. (mandatory)
 - **Predicted Archaeological Sequence:** this will be produced as maps and possibly an interpretive section focused on the location of the scheme elements identified in the scope. The map will identify deposit depths, areas of previous ground disturbance and areas of archaeological potential. Cross sections should be included where deep deposits are predicted. (where relevant to the objectives of the DDBA – this element is likely to be very important for

assessments designed to inform construction and design processes.)

- **Cartographic, pictorial and image data:** Relevant maps, aerial photographs, Lidar data, hyperspectral data and any other useful imagery will be georeferenced and produced as drawings with overlays of relevant scheme elements and construction boundaries. (mandatory)
- **Archaeological Character Area Mapping.** If appropriate to the location. (where relevant to the objectives of the DDBA)
- **Impact drawings:** These will show the areas (in plan and section) where impacts on heritage assets are predicted, and where design input is required, or further investigations are recommended. The drawings will identify specific components of the scheme in relation to identified and predicted heritage assets (where relevant to the objectives of the DDBA). These will be composite plans and will take into account the predicted archaeological sequence, areas of known modern ground disturbance, scheme components and known heritage assets.

Gazetteer of assets

- 3.10.21 The gazetteer will provide a list of heritage assets identified in the DDBA including the source of information for all assets identified through the research. This will link the assets into Phase One of HS2 by identifying and describing which project elements have a potential impact to the asset. The gazetteer will also provide all pertinent details of the asset including location, map reference, co-ordinates, name, type, designation, description, period (if known) and significance.
- 3.10.22 The gazetteer will cross reference the HS2 Phase One Environmental Statement Unique ID and utilise the same format.
- 3.10.23 The gazetteer will be produced as a separate Excel Spreadsheet and will be inserted into the Appendix of the DDBA in Word format.

4 Specialist methodologies for investigation

4.1 Section introduction

4.1.1 The following section provides the methodologies and guidance to be selected and included in the preparation of Project Plans and LS-WSIs. The preparation of Project Plans and LS-WSIs will be in accordance with the *Specification for historic environment Project Plans and Location Specific Written Schemes of Investigation* (HS2-HS2-EV-STD-000-000036) .

4.1.2	The methodologies in section 4 shall be applied by the <i>Contractor</i> as standards and minimum requirements for each type of investigation.
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4.1.3 At the front of each section a criteria of relevance is provided to indicate under what circumstances the archaeological investigation may be used. Text can be used and/or adapted (where appropriate) within Project Plan's / LS-WSI's.

4.1.4 Figure 1 outlines the broad location within the historic environment investigation process for each of the types of investigation, and the outputs/deliverables from the investigations.

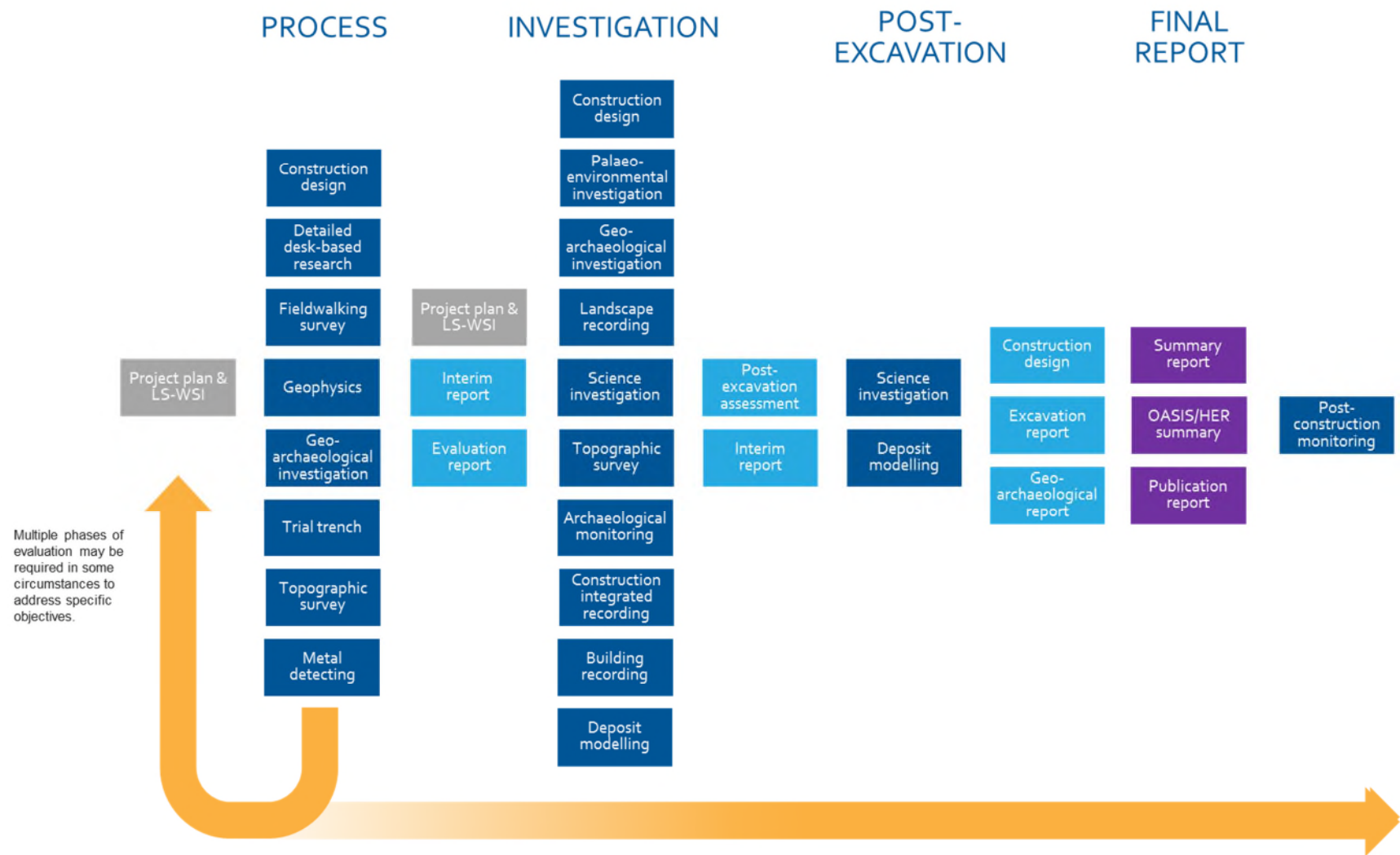


Figure 1: HS2 Historic Environment Investigation Process Map

4.1 Methodology for setting out

Criteria of relevance

4.1.1 *Setting out is necessary for the following archaeological investigations:*

- *Geophysical survey (magnetometer, earth resistance, GPR, electrical resistance tomography)*
- *Fieldwalking*
- *Metal detector survey*
- *Topographic survey including GNSS total station survey and terrestrial laser scan survey. Other forms of survey e.g. UAV surveys may not require setting out)*
- *Intrusive investigation (geoarchaeological trial trenching, archaeological trial trench investigation, archaeological recording)*
- *Historic building recording (some simple photographic records may not require setting out)*
- *Historic landscape recording*

Methodology

Intrusive investigations

- 4.1.2 All spatial setting out and recording shall be in accordance with The Ordnance Survey National Grid and Ordnance Survey Newlyn Datum (ODN) as defined by the OS Active Global Navigation Satellite System (GNSS) network and use of a Virtual reference system. A minimum of three Permanent Ground Markers (PGM) shall be created using this system for each intervention or group of geographically related interventions.
- 4.1.3 Interventions shall be located to a horizontal accuracy of +/-500mm in relation to the detail illustrated in the contract drawing(s). The corner points of each excavation or the centre point of each soil core location shall be set out with Real Time Kinematic (RTK) Global Navigation Satellite System (GNSS) equipment or other suitable automated equipment referenced from the PGMs.
- 4.1.4 Surface heights shall be recorded using RTK GNSS and related to PGMs. Ordnance Survey Bench Marks (OSBM) are not to be used. Levelling accuracy shall be within 10 mmÖk: where 'k' is the total distance levelled in kilometres.
- 4.1.5 The *Contractor* shall include details of their surveying methodology within the Project Plan / LS-WSI method statement.
- 4.1.6 The survey report shall include those items given in the template included as an appendix to the report.

- 4.1.7 The *Contractor* shall ensure that all trench or excavation limits, and significant archaeology detail are surveyed 'as dug' in relation to the project grid before leaving the site. Ground level height data shall be recorded for each intervention. Survey methodology and a detailed survey record shall be provided to the *Employer* within the survey report.

Geophysical, fieldwalking, metal detecting and topographic surveys

- 4.1.8 Where appropriate, data may be collected using equipment incorporating a live RTK GNSS feed or tracking robotic total station thus negating the need to set out a referenced survey grid.
- 4.1.9 Grid nodes shall be set out with an error no greater than +/- 0.1m. Where site conditions allow, referencing shall be carried out using Real Time Kinematic (RTK) GNSS equipment. If the site is unsuitable for GNSS (for example dense tree cover) then a Total Station Theodolite (TST) shall be used. When taking referencing measurements using a TST, semi-permanent points shall be selected for measurements. These may include features such as buildings or walls, but not poorly defined overgrown field boundaries. If no such semi-permanent feature is accessible then survey markers may be used and left in situ (this must be by written agreement with the *Employer*). Magnetometer and earth resistance surveys shall normally be carried out within a grid system. Grids for magnetometer and earth resistance surveys will usually be 20mx20m or 30mx30m with temporary markers inserted at each grid node.
- 4.1.10 Ground penetrating radar data shall be referenced to the same grid system and collected along parallel or orthogonal lines.
- 4.1.11 Electrical resistivity tomography shall be collected along individual lines with a node at each end.
- 4.1.12 Fieldwalking transects should generally be aligned parallel to the longest boundary of the individual field being surveyed and spaced at 20m intervals. Transects should be tied in to the OS grid. The length of each transect should be subdivided into a series of 20m stints.
- 4.1.13 The *Contractor* shall include details of their surveying methodology within the *Contractor's* method statement including the setting out of the grid and how they intend to provide the project grid co-ordinates to HS2 with the survey report.
- 4.1.14 Survey methodology and a detailed survey record shall be provided to HS2 within the survey report.

4.2 Methodology for magnetometer survey

Criteria for relevance

- 4.2.1 *Magnetometer survey can detect a wide variety of archaeological features and is usually the preferred method of geophysical survey for most sites. It can detect structures including cut features, earthworks, pits, burnt structures such as kilns and hearths, ridge & furrow ploughing and field boundaries.*
- 4.2.2 *Magnetometer survey is best deployed over larger rural sites where there has been limited modern ground disturbance. Typically in blocks greater than 1ha. Smaller areas can be surveyed provided they are not obstructed by ferrous objects that may have a severely detrimental effect on the quality of results, such as fences, pylons, buildings, farm machinery and buried utilities. Linear corridor surveys may be carried out, though their narrow nature makes them more susceptible to the negative effects of adjacent ferrous obstructions, particularly if the corridor runs along a fence line. To help mitigate this effect corridor surveys should be at least 30m wide and where possible located away from known obstructions.*
- 4.2.3 *Consideration must also be given to the geological environment. Some rock types and superficial deposits can suppress or obscure archaeological anomalies. The Contractor will be required to ensure that these issues are addressed when designing surveys.*
- 4.2.4 *Steeply sloping topography and rough ground conditions underfoot (including crops and vegetation) may also limit the surveyable area. Carry out a reconnaissance site walkover prior to commencing the survey to check for any potential obstacles.*

Methodology

- 4.2.5 Magnetometer surveys shall be carried out in accordance with Historic England Geophysical Survey in Archaeological Field Evaluation, 2008. Data shall be gathered using Bartington Grad601-2 instruments. Other equipment may be used only with the prior written agreement of the *Employer*. The *Employer* welcomes innovation in respect of differing equipment and survey techniques where such techniques can support the delivery of Specific Objectives set out in the GWSI: HERDS.
- 4.2.6 As a minimum data shall be gathered every 0.25m along parallel lines 1m apart. The total number of data points collected shall be 1600 readings per 20m x 20m grid square or 3600 per 30m x 30m square. If appropriate a closer sample interval and line separation may be required.
- 4.2.7 Wherever possible, data should be collected using equipment incorporating a live RTK GNSS feed or tracking robotic total station thus negating the need to set out a referenced survey grid.
- 4.2.8 Geophysical survey personnel shall be suitably qualified and experienced to undertake the work. When requested, the *Contractor* must submit copies of staff CVs to the *Employer*.

4.3 Methodology for earth resistance survey

Criteria for relevance

- 4.3.1 *Earth resistance survey is suited for the location of structures. Data collection can be time consuming and so is best reserved for use on small sites, or as part of a targeted strategy, or where more rapid techniques are not suitable. Surveys may be targeted in particular areas where there is evidence to suggest hard structures may exist.*
- 4.3.2 *Earth resistance survey relies on moisture contrasts within the ground. Ideally surveys will not be carried at the height of summer or during extended periods of rainfall when ground moisture content will be more uniform with reduced contrasts.*
- 4.3.3 *Steeply sloping topography and rough ground conditions underfoot (including crops and vegetation) may limit the surveyable area.*

Methodology

- 4.3.4 Earth resistance surveys shall be carried out in accordance with English Heritage (2008) guidance on Geophysical Survey in Archaeological Field Evaluation.
- 4.3.5 The standard array shall be twin probe with a mobile probe spacing of 0.5m. As a minimum data shall be gathered every 1m along parallel lines 1m apart. The total number of data points collected shall thus be 400 readings per 20m x 20m grid square or 900 per 30m x 30m square. Some cart systems use a square array which will also be suitable. If using a square array both alpha and beta measurements should be gathered.
- 4.3.6 Geophysical survey personnel shall be suitable qualified to undertake the work. When requested, the *Contractor* must submit copies of the proposed staff CVs to the *Employer*.

4.4 Methodology for Ground Penetrating Radar (GPR)

Criteria for relevance

- 4.4.1 *GPR is a high resolution technique and is the only method that is able to function over hard surfaces. It can be deployed in urban or other developed locations where intense modern ground disturbance may rule out other methods, and in particular over hard surfaces such as carriageways, footways and car parks etc.*
- 4.4.2 *GPR is primarily suited to the location of hard features such as brick and stone structures but can also be used to locate earthwork features and burials. It can be used in small spaces and easily worked around obstructions which add to its usefulness in urban locations. Similarly with earth resistance surveys it can be used as part of a targeted strategy on sites where there is evidence that brick and stone structures may exist. Its higher resolution means it can also be used to target anomalies identified by other techniques to assist characterising the response and to add depth information.*

- 4.4.3 *Steeply sloping topography and rough ground conditions underfoot (including crops and vegetation) may limit the surveyable area.*

Methodology

- 4.4.4 GPR shall be carried out in accordance with English Heritage Geophysical Survey in Archaeological Field Evaluation guidance..
- 4.4.5 Trials shall be carried out using a range of different frequency antennas. These shall usually be in the range of 200MHz – 800MHz centre frequencies. The frequency that shows the best results compromising data resolution with penetration depth shall be deployed for the main survey. In some circumstances it may be required to use frequencies outside of this range, this shall be identified in the project plan; for example a higher frequency may be required to provide detail on particularly shallow deposits of interest. In some cases it may be necessary to carry out surveys using more than one centre frequency to image both shallow and deep features.
- 4.4.6 As a minimum, data will be gathered along parallel traverses no wider than 0.5m apart (although this will be dependent on the centre frequency), traces should be taken at least every 0.05m along each traverse. Where possible traverses should be oriented perpendicular to any known archaeological features.
- 4.4.7 Contractors operating GPR systems must be in possession of an OfCom licence and preferably hold membership of EuroGPR. Surveys will be carried out in accordance with the appropriate licence and membership requirements.
- 4.4.8 Geophysical survey personnel shall be suitable qualified to undertake the work. When requested, the *Contractor* must submit copies of the proposed staff CVs to the *Employer*.

4.5 Methodology for Electrical Resistance Tomography (ERT)

Criteria for relevance

- 4.5.1 *ERT lines are best used as part of a targeted strategy. They can be used to identify particularly deep and large features, or to define the base of a stratified sequence (such as in a burial ground) and to help characterise the natural landscape such as the depth to the water table and bedrock. Where appropriate the Project Plan and LS-WSI will specify the requirement of ERT.*
- 4.5.2 *ERT relies on moisture contrasts within the ground. Ideally surveys will not be carried at the height of summer or during extended periods of rainfall when ground moisture content will be more uniform with reduced contrasts.*

Methodology

- 4.5.3 ERT shall be carried out in accordance with English Heritage Geophysical Survey in Archaeological Field Evaluation.

4.5.4 An appropriate array set up should be selected to gain sufficient resolution and penetration depth.

4.5.5 Geophysical survey personnel shall be suitable qualified to undertake the work. When requested, the *Contractor* must submit copies of the proposed staff CVs to the *Employer*.

4.6 Methodology for fieldwalking survey

Criteria for Relevance

4.6.1 *Fieldwalking is used as an evaluation technique to identify and map the potential extent of certain forms of archaeology within a specified location. For some forms of archaeological material e.g. scatters of Mesolithic flint work, it can also be a very effective sampling tool for understanding the distribution of activity in the landscape and may be the only reliable large-scale way of identified and investigating this material. Fieldwalking is therefore not considered to just be an "evaluative" tool.*

4.6.2 *It is a non-intrusive technique that samples the upper surface of cultivated or disturbed ground. As such fieldwalking surveys must be timetabled to take place when arable fields are lying fallow and preferably immediately after ploughing/harrowing. Where this is not practical fieldwalking can be undertaken in less favourable ground conditions. Once the Employer has control of the LLAU it may be possible for areas of land to be ploughed specifically to support fieldwalking activity.*

4.6.3 *Fieldwalking is appropriate for agricultural locations where the ground conditions favour the preservation of archaeological artefacts.*

Methodology

4.6.4 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.

4.6.5 Individual fields within any survey should be numbered.

4.6.6 Surveys will be carried out using line walking where survey teams traverse linear transects collecting material that they see within their corridor of vision. Survey teams should typically walk transects and observe 2m-wide corridors centred on each individual transect as a basis for artefact collection. Closer or wider spacing of transects may also be considered as appropriate and will be decided by the *Contractor* with the agreement of the *Employer* through the Project Plan.

4.6.7 Survey teams will have an allotted time, as specified within the Project Plan, to recover finds in the linear transect. An equal amount of time will be spent on each transect.

4.6.8 Artefacts recovered from each individual stint should be bagged together. Bags should be marked with the site code, the alphanumeric transect number and the stint.

- 4.6.9 The strategy for collection, sampling or weighing all materials will be tailored to the expected conditions of the site and the specific research aims of the individual fieldwalking survey.
- 4.6.10 Concentrations of certain materials such as stone, slag and tile may be sampled only and have their extents recorded by GNSS.
- 4.6.11 The presence of all classes of artefact will at a minimum be recorded and distribution plots made prior to any decision being made as to discard.
- 4.6.12 Record sheets should be completed, ideally digitally, for each field, detailing land use, ground conditions, visibility and survey personnel.

4.7 Methodology for metal detector survey

Criteria for relevance

- 4.7.1 *Metal detecting surveys are a relatively rapid, non-intrusive method of gathering information about particular forms of archaeological materials. Artefacts recovered during a metal detecting survey can help indicate the character, extent, date and significance of below-ground archaeological remains that may be present. Metal detection is only practicable on land in fallow, shortly after ploughing or harrowing or under short pasture.*
- 4.7.2 *The primary objective of a metal detecting survey is to provide information about aspects of the likely archaeological resource within the survey area, including its character, extent, date and significance. Survey results can inform further historic environment investigations and can support other ongoing investigations. Detecting for all metals may also be required for potential battlefield sites in order to maximise the recovery of associated artefacts.*
- 4.7.3 *Metal detection can form an important element of archaeological evaluations and investigations. It should therefore be considered as an element for inclusion within all Project Plans where recovery of metal finds is expected.*

Methodology

General

- 4.7.4 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.7.5 Metal detecting survey specifications shall be set out in the Project Plans in accordance with ClfA and Historic England best practice guidelines including the Code of Practice for Responsible Metal-Detecting in England and Wales (English Heritage 2014 Our Portable Past).
- 4.7.6 Specifications as a minimum shall identify non-pick up strategies, standards for recording, survey resolution, need for specialist artefact advice spatial location recording standards, retention and disposal strategies and reporting and project archive requirements.

Methodology for metal detecting

- 4.7.7 A series of transects should be established within the individual fields to be surveyed. These transects will generally be aligned parallel to the longest boundary of the individual field being surveyed and spaced at 10m intervals. Closer or wider spacing of transects may also be considered as appropriate and should be applied iteratively should a survey indicate the presence of concentration of metallic responses (for example the location of a coin hoard or falls of shot).
- 4.7.8 Metal detecting should progress along each transect. Each sweep of the metal detector should cover a width of c. 2m (1m each side of the transect). The search head should be kept as close to the ground surface as possible.
- 4.7.9 The survey should initially target non-ferrous metals only, due to the potential for a large number of ferrous metal signals across most land. Should concentrations of medieval or earlier material be identified, then further detecting for all metals may be necessary in those specific areas.
- 4.7.10 Artefacts should be removed from the ground using a trowel or other technique as appropriate for conservation. No artefacts should be removed from a depth greater than the ploughsoil (c. 300mm). Artefacts should be labelled with a unique ID number and their individual locations plotted using a GNSS. Artefacts of undoubted modern date should be collected and bagged together by transect and a single ID number allocated.
- 4.7.11 Artefact distribution plots and associated commentary reports will be produced at survey completion. Artefact concentrations can suggest areas of the site for further archaeological investigation and can inform any archaeological investigation strategies, if appropriate.

4.8 Methodology for topographic survey

Criteria for relevance

- 4.8.1 *Topographical survey is a controlled measurement of natural and artificial landscape features. The survey can then be presented as a two-dimensional or three-dimensional plan. It may also be used to create profiles or a digital terrain model.*
- 4.8.2 *Topographic survey is the most appropriate method of recording extant earthworks as part of, or prior to, a scheme of archaeological fieldwork, or repair to a monument, or alternatively as the only record where the remains are to be presented to the public.*

Methodology

- 4.8.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.8.4 Survey may be achieved with digital or traditional methods, but the format of the interpretative drawings generated from the survey shall be agreed with the *Employer* through

the Project Plan before commencement of site work. Topographic survey specifications shall be set out in the Project Plan in accordance with ClfA and Historic England best practice guidelines.

- 4.8.5 Topographic survey will provide an accurate record of the topography of a site and precisely map the location of features that will be the subject of subsequent recording actions such as intrusive archaeological investigation and/or specialist photography.
- 4.8.6 To ensure adequate site cover survey markers and points of reference, established when setting out, will be at a reasonable proximity to the perimeter of the survey area and the detail to be mapped. These points will be chosen by the *Contractor*.
- 4.8.7 The appropriate technique to conduct a topographic survey will be decided by the *Contractor* with the approval of the *Employer*. This will include consideration of Unmanned Aerial Vehicle (UAV) surveys.

4.9 Methodology for GNSS total station survey

Criteria of relevance

- 4.9.1 *The methodology set out in this section is for the use of the GNSS total station in topographic survey. The total station is also used in archaeological excavation and historic building recording but guidance for those investigation techniques is available in the relevant best practice guidance. The GNSS total station is capable of producing highly accurate surveys in almost all terrain and can produce data for two-dimensional and three-dimensional data outputs.*
- 4.9.2 *The GNSS total station survey method is more time consuming and produces a lower level of resolution than terrestrial laser scan topographic survey. However, it is a versatile and reliable technique*

Methodology

Survey Control

- 4.9.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.9.4 Permanent and temporary survey control stations will be established according to good survey practice. Permanent stations should be one of the following type, in order of preference:-
- marker or type as agreed the *Employer*;
 - earth anchor;
 - stainless steel nail (e.g. PK nail); or
 - cut mark or punch mark.

- 4.9.5 The type of marker used for temporary stations can be any of the following, depending upon the above criteria:
- wooden peg or stake;
 - stainless steel nail (e.g. PK Nail) or hilti nail; or
 - cut mark or punch mark.
- 4.9.6 The OS co-ordinates of the survey stations will be established using GNSS, with an expected accuracy of +/- 20 mm.
- 4.9.7 All horizontal and vertical control shall be derived directly or indirectly from the OS Net.
- 4.9.8 At least two network RTK stations will be observed on a site and if one is required as an RO for total station observations, then there will be sufficient distance between them for a 'strong' bearing control.
- 4.9.9 Observations should be made in accordance with TSA guidance notes using at least two periods of three minute observations separated by at least 20 minutes.
- 4.9.10 Observations will be pre-planned so that each window of observations can be made under different satellite configurations.
- 4.9.11 A survey control coordinate list will be created from the measured control points
- 4.9.12 Spirit level run misclosures should be assessed by using Clark's Formula of:
- For level runs less than 1km: $E = 0.005 \sqrt{N}$ (where N = No. of set ups); or
 - For level runs greater than 1km: $E = 0.012 \sqrt{D}$ (where D = traverse length in kilometres)
- 4.9.13 For guidance on good practice, the RICS Guidelines for the use of GNSS in *Surveying and Mapping* (ISBN 1842190938) should be used as reference.
- 4.9.14 Detail data will be captured using the GNSS and/or Total Station instruments to RICS accuracy band E according to RICS 2014 *Measured surveys of land, buildings and utilities* (Guidance note global 3rd edition). This will include logging coded points and string lines in a format compatible with the *Employer's* BIM requirements.
- 4.9.15 All earthworks are to be included in the survey detail capture using bank top and bank bottom (or HS2 equivalent) codes.
- All structures will be included in the survey detail capture;
 - Locations and heights of all archaeological features will be included in the survey detail capture;

- Location of any ruins of archaeological significance will be included in the survey detail capture;
- Edge of vegetation should be included in the survey detail capture indicating the extent of vegetation significant enough to obscure the detailed survey of an area; and
- All visible boundary features should be included in the survey detail capture including; fences, gate hedges, walls, stones, beacons, posts and trees.

4.9.16 Exceptionally where it will be more informative, a detailed topographic survey using a grid system of spot levels should be undertaken, with a regular point interval sufficient enough to capture topographical details and reflect changes of level.

4.9.17 Detailed topographic survey should be supported by hand measurement, field notes and photographs where deemed necessary.

4.10 Methodology for terrestrial laser scan survey

Criteria of relevance

4.10.1 The section sets out the methodology for terrestrial laser scanning in topographic survey. Laser scanning is capable of providing a large quantity of three-dimensional measurements to be collected quickly. This is useful for large area and complex surveys. Terrestrial laser scans are not used in isolation and often rely on control provided by terrestrial survey instrumentation such as a GNSS total station.

4.10.2 Laser scan survey requires line of sight to the object being recorded, obstructions such as dense vegetation limit its capability. Scanning systems have minimum and maximum ranges over which they operate. Scanning above or below these ranges should be avoided to prevent inaccurate data capture. It is best suited to the recording of surface information, rather than to edges and discrete points. Scanning, and in particular post-processing of the scan data, is also a time consuming process and terrestrial laser scanning may be considered unnecessary for the requirements of a topographical survey.

Methodology

4.10.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.

Survey Control

4.10.4 Permanent and temporary survey control stations will be established according to good survey practice. Permanent stations should be one of the following type, in order of preference:

- marker or type as agreed the *Employer*;
- earth anchor;

- stainless steel nail (e.g. PK nail); or
- cut mark or punch mark.

4.10.5 The type of marker used for temporary stations can be any of the following, depending upon the above criteria:

- wooden peg or stake;
- stainless steel nail (e.g. PK Nail) or hilti nail; or
- cut mark or punch mark.

4.10.6 A series of survey control stations will be identified or installed which will provide sufficient coverage of the areas of burial ground to be surveyed, and are either inter-visible, or offer views to suitable mapped control.

4.10.7 The OS co-ordinates of the survey stations will be established using GNSS, with an expected accuracy of +/- 20 mm.

4.10.8 All horizontal and vertical control shall be derived directly or indirectly from the OS Net.

4.10.9 At least two network RTK stations will be observed on a site and if one is required as an RO for total station observations, then there will be sufficient distance between them for a 'strong' bearing control.

4.10.10 Observations should be made in accordance with the TSA guidance notes using at least two periods of three minute observations separated by at least 20 minutes.

4.10.11 Observations will be pre-planned so that each window of observations can be made under different satellite configurations.

4.10.12 A survey control coordinate list will be created from the measured control points

4.10.13 Spirit level run misclosures should be assessed by using Clark's Formula of:

- For level runs less than 1km: $E = 0.005 \sqrt{N}$ (where N = No. of set ups); or
- For level runs greater than 1km: $E = 0.012 \sqrt{D}$ (where D = traverse length in kilometres)

4.10.14 For guidance on good practice, the RICS Guidelines for the use of GNSS in Surveying and Mapping (ISBN 1842190938) should be used as reference.

Survey Detail

4.10.15 Any laser Scanning data capture will follow the following:

- *3D Laser Scanning for Heritage 2nd Edition* (Historic England 2011b); and

- *Measured and Drawn; Techniques and Practice for the Metric Survey of Historic Buildings 2nd Edition* (Historic England 2008b); and

- 4.10.16 Any scan location will be set up either on the established control points or resected from established control points to maximise data coverage and minimise the number of setups needed. Overlapping scans will be taken of each structural surface to guarantee a high point density, ensuring that no voids are left in the survey.
- 4.10.17 For general topographic survey a point distribution of 5mm will be required to record a level of detail sufficient to enable subsequent detailed drafting and analysis to take place. It is recommended that any areas of fine detail be rescanned at a higher resolution to ensure that the data is sufficient for interpretation and digitising. For this purpose it is recommended that fine architectural detail be scanned at a point distribution of 1mm.

Data Processing

- 4.10.18 The dataset will be processed into a 3D point cloud from which linework drawings and 3D models can be derived. It should also be capable of delivery as an E57 or LAS dataset for use in Esri ArcGIS.
- 4.10.19 All extraneous data will be cleaned from the point cloud dataset prior to delivery
- 4.10.20 Deliverables shall include:
- A 2D topographic linework plan of the site at an appropriate scale (depends how large the site is but 1:200 is not uncommon;
 - A 2D contour map of the site at a similar scale;
 - 2D Elevations of any structural remains of archaeological significance;
 - For TLS scanned data a vertically exaggerated isometric visualisation may be useful, when combined with different illumination directions this may prove useful in identifying subtle landscape features;
 - A Digital Terrain Model GeoTIFF derived from the TLS data for use in GIS;
 - A Digital Terrain Model Triangulated irregular network (TIN); and
 - A registered, unified and cleaned point cloud in E57 or LAS format (colour – RGB values).

4.11 Methodology for deposit modelling

Criteria for relevance

- 4.11.1 *Archaeological investigation of deeply stratified sedimentary sequences, such as lowland river valleys, can be problematic due to the excessive depth of the deposits, associated high water table or ground instability. Deposit modelling will be relevant where deep (>2m) Quaternary*

deposits are encountered to provide an understanding of the buried landscape and early determination of the archaeological and research potential of such buried deposits. It may also be utilised on shallower deposits to address questions such as the likely preservation of intact deposits below the plough soil.

- 4.11.2 *In addition to historic engineering data e.g. existing geotechnical test-pit and borehole logs and reports, deposit modelling may draw on data produced during geoarchaeological trench investigation, archaeological borehole investigation and monitoring of new geotechnical test-pits and boreholes.*

Methodology

- 4.11.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.11.4 Data collation should be undertaken by an experienced geoarchaeologist. An assessment of the available data will permit the definition of a series of lithologies (downhole rock or material types that aren't necessarily layered in a specific order) and stratigraphies (interpreted formations, often groups of lithologies, which are normally distinctly layered in nature and consistent in their order from the surface downward).
- 4.11.5 Both lithology and stratigraphy will vary along the route corridor, to reflect local variations in underlying geology and superficial deposits (especially in urban areas), and may therefore need to be location specific. In order to ensure scheme-wide consistency on the application, and designation, of lithological and stratigraphic units (including colour and symbology) the *Contractors* will liaise with the *Employer* during the production of Project Plans to undertake version control and dissemination. For geological units, the BGS Lexicon of Named Rock Units should be consulted.
- 4.11.6 Data for inclusion within any deposit model should be screened to ensure that the following information (as a minimum) can be derived before its inclusion:
- Easting and Northing (using an agreed geographic reference system such as British National Grid (based on the OSGB36 datum) or an HS2 adopted Pseudo Grid (PG) system), along with accuracy of locational data;
 - Elevation (such as m Ordnance Datum Newlyn), along with accuracy of vertical measurement;
 - Description of each sedimentary unit and, if available, interpretation; and
 - Depth (below surface) of each sedimentary unit boundary.
- 4.11.7 While borehole records (derived from hand, power or commercial drilling rigs) may form the basis of any deposit model, datasets from other sources should be utilised wherever possible. Data sources which can inform a deposit model include geophysical surveys (e.g. ERT and

GPR, Cone Penetrometer Test (CPT), existent (historic) records (e.g. BGS GeoIndex), geotechnical trenches or recorded exposures.

- 4.11.8 Deposit modelling should only be undertaken by a suitably trained and experienced geoarchaeologist using suitable software, such as RockWorks. Deposit modelling should be used to provide predictions of the type, and distribution, of different sedimentary deposits (and those with archaeological potential) across a site. The *Employer* will require consistent methodologies to be utilised for the different phases of deposit modelling. This will ensure that both processing and reporting is standardised across the scheme. Typically borehole data will be prepared within a spreadsheet / database and copies of the data should be centrally held.
- 4.11.9 Outputs (both illustrative and digital – e.g. digital surface models) should include, but not be limited to:
- intersecting borehole transects (which must be accompanied by a map showing their site location);
 - modelled surfaces (such as the underlying geology);
 - modelled thickness of deposits (such as organic deposits or overburden (made ground)); and /or
 - 3D models of the site stratigraphy / lithology.
- 4.11.10 All deposit models produced should be accompanied by metadata outlining the parameters utilised during the modelling process, especially for modelled surfaces, thickness maps and any 3D modelling. The metadata, to accompany the output data, should clearly outline the steps taken to produce the resultant models include interpolation method applied (including specific settings), list of boreholes / datapoints used, software name and version, geographical extent modelled, additional datasets used to constrain the model (such as Lidar or other surface topography measurements) and output datasets (including name and version control).
- 4.11.11 Deposit modelling is a predictive tool, often based upon spatially variable data sources, and therefore any derived models (particularly generated surfaces) should also include an indication of data source distribution and confidence that can be assigned to any model (see Lark *et al.* 2013 for further guidance). Where there is significant extrapolation of the model beyond the available dataset this should be clearly identified and may require further site investigation. The deposit model should be revised as more data becomes available throughout the project.
- 4.11.12 Further guidance on Georachaeology is provided in Historic England (2015) *Geoarchaeology: Using earth sciences to understand the archaeological record* For further detailed methodology

on deposit modelling refer to *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*, pp. 38-43 (Gribble and Leather, 2011).

Reporting

- 4.11.13 The *Employer's* standard templates for reports and maps will be used for all data and reports produced. The report shall include reference to the unique land parcel identification number that has been allocated by the *Employer* land access teams. Reports will contain figures accompanied by a supporting text document. Figures may be on A4, A3, or A1 paper size as determined by the size and shape of the site and plotting scale required. All figures within a report shall normally be on the same paper size.
- 4.11.14 The final report deliverable will comply with the standard approach set out in the *Employer's Cultural Heritage GIS Specification* (HS2-HS2-GI-SPE-000-000004) and the *Geographical Information System Standards* (HS2-HS2-GI-STD-000-000002).

4.12 Methodology for geoarchaeological trench investigation

Criteria for relevance

- 4.12.1 *Trial trenches for geoarchaeological purposes provide:*
- *the opportunity to observe the stratigraphic sequence in section; and*
 - *access to larger volumes of samples than is achievable through coring.*
- 4.12.2 *Trial trenches will be suitable for accessing / observing shallow deposits (e.g. uppermost 2-3m). These may be utilised at the initial site investigation stage, in order to establish the geoarchaeological potential within an areas, or for purposeful ground truthing (e.g. investigate deposits observed in aerial photography or deposits encountered during initial coring) and to provide access to deposits for geoarchaeological sample (including palaeoenvironmental and dating techniques).*

Methodology

General

- 4.12.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.12.4 Specification for geoarchaeological investigation shall be in accordance with Historic England published guidance and, where appropriate, will take into account advice from the Historic England regional scientific advisor.

Geoarchaeological investigation

- 4.12.5 The location and objectives of the trial trenches will be set out in the Project Plan. Each trial trench will be assigned a unique ID in accordance with the *Employer's* Asset Information Management System (AIMS). The dimensions of each trial trench in plan, inclusive of the

trench support system employed (if required) to secure personnel entry to the excavation, shall be set out in the Project Plan and LS-WSI. Trial trenches shall be excavated to a depth specified in the Project Plan, or until a specified sedimentary unit is encountered (e.g. underlying geology). This shall be dependent on the agreed objectives of the excavation.

- 4.12.6 The *Contractor* shall supervise the excavation of each trial trench in such a manner so as to allow a cumulative or continuous section to be recorded. In excavating alluvial sequences the *Contractor* shall pay particular attention to establishing the vertical extent of layers of archaeological potential and shall be aware that horizons of cultural activity may be interdigitated with horizons of sterile alluvium. The *Contractor* shall undertake hand excavation and cleaning of any archaeologically significant horizons.
- 4.12.7 The *Contractor* shall ensure that water is discharged and excavated material from archaeological excavations are stored in accordance with the *Contractor's* environmental protection requirements (as set out in the package Works Information and their Environmental Management Plan) and any relevant consents for the worksite. The *Employer* shall monitor discharge rates and if necessary conductivity of discharge waters to ensure compliance.
- 4.12.8 Where geoarchaeological trial trenches are unsafe to enter, the geoarchaeologist will be able to inspect the excavated sediments and direct the excavator accordingly so that material is placed at a safe distance from both the trial trench and plant equipment and can be sampled accordingly. In this instance the geoarchaeologist will make a record of the sedimentary sequence following conventional standards (e.g. Historic England Geoarchaeology guidance) and include sediment structure, colour, texture and sorting and (where these are preserved within the excavated sediments) boundary characteristics. Depths of each stratigraphic boundary will be measured or, where unsafe to approach the edge of the trench, estimated and recorded as such.
- 4.12.9 Where entry into the trial trench is safe to do so, buried soils and sediment sequences shall be inspected and recorded by the *Contractor's* geoarchaeologist to provide data for understanding site formation processes. Procedures and techniques presented in Historic England guidance (e.g. Environmental Archaeology; Geoarchaeology) shall be followed. Samples for laboratory assessment shall be collected where appropriate, following agreement with the *Employer*.

4.13 Methodology for archaeological borehole investigation

Criteria for relevance

- 4.13.1 *Boreholes provide a rapid method to understanding the buried sedimentary sequence at a site and to obtain samples for assessment in order to assess archaeological potential. It is of particular use for developing an understanding of deep sedimentary sequences.*

- 4.13.2 *In relation to conventional geoenvironmental trench evaluation, boreholes can be used as a first phase where the results need to characterise the local sedimentary sequence and help pinpoint trench locations. Boreholes / coring may also provide a suitable approach when the use of trenches may be deemed unsafe (such as deeply buried deposit or local water table considerations, including flooding), where the impact is constrained (such as piling), or as a specific investigation tool. The latter may include purposeful coring to identify and recover deep material identified within geophysical surveys, targeted coring for ground truthing of deposit models, or purposeful coring along floodplain edges to establish to the extent and quality of preservation of archaeological horizons.*

Methodology

- 4.13.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.13.4 Three principle equipment types are available for boreholes / coring:
- Commercial drilling rigs (percussion or rotary corer);
 - Power auger; and
 - Hand auger.
- 4.13.5 Advice on the suitability of such equipment, for geoarchaeological recording, is provided in the Historic England Geoarchaeology guidance, but will also be determined by project objectives (including work required by site engineers), depth of deposits and requirements for sample collection (including volume of material retrieved).
- 4.13.6 Unless agreed with the *Employer* through the Project Plan, each core collected for archaeological purposes should be supervised by an experienced geoarchaeologist who will also note the depths of the deposits and ensure that samples are collected and labelled to an archaeological standard. They will also ensure that each coring location is accurately surveyed and levelled in to the agreed vertical datum.
- 4.13.7 Each core sample hole shall be assigned a unique number by the *Contractor*.
- 4.13.8 The proposed methodology and equipment type (including core chamber and casing diameter) should be selected to fulfil the aims of the investigation which will be set out in this Project Plan and specified in the *Contractor's* method statement. Sample diameter shall be selected in consideration of local ground conditions but should be in the range of 50mm to 100mm depending on strata. Sampling tube length should be capable of retrieving minimum sample length of 400mm and maximum of 2000mm.
- 4.13.9 Where samples will be required for palaeoenvironmental assessment or dating, a suitable coring technique should be selected whereby contamination is minimised (e.g. use of plastic liners within the coring tube). If cored samples will be used for Optically Stimulated Luminescence (OSL) dating then dedicated opaque plastic liner should be used to avoid

contamination by sunlight. These samples can then be taken directly to an OSL laboratory where they can be sub-sampled under controlled laboratory lighting conditions. (see English Heritage guidance on Luminescence Dating).

- 4.13.10 Where recording of the core takes place in the field (e.g. hand auger or window sampling without a plastic liner) the *Contractor* shall log the stratigraphic sequence in the field through close observation of sample contents.
- 4.13.11 The sedimentary record shall be recorded through use of graphic logs and written description by the *Contractor's* suitably qualified geoarchaeologist. As a minimum all logs must include the following descriptive information within a tubulised form:
- Sample Unique Identification Number
 - Location (XY coordinates)
 - Level of the top of the sample (e.g. m OD)
 - Depth for top and bottom of each lithological unit
 - Depths for poor / no sediment retrieval
 - Description of each lithological unit, follow conventional standards (see Historic England Geoarchaeology guidance) and including
 - sediment structure;
 - colour (e.g. using a Munsell colour chart);
 - texture; and
 - sorting and boundary characteristics.
 - Sampling locations (including purpose of sampling and unique sub-sample code)
- 4.13.12 Any sediment loss during coring should be recorded by the geoarchaeologist, including depth range (below surface) of loss. Cores should be properly sealed (to avoid moisture loss) if they are to be temporarily stored / transported back to the processing facilities.
- 4.13.13 Soil core sample holes shall be drilled and reinstated in accordance with the Project Plan, Works information, or other instruction from the *Employer*, to protect the groundwater, minimise contamination pathways and/or address any other residual hazards. Should a significant obstruction be encountered before reaching the target depth an additional hole shall be drilled, at a distance of at least 1.0m from the survey point, at the discretion of the *Contractor*. Should the additional core encounter an obstruction of a similar nature the circumstances shall be recorded and the excavation ceased. Such additional cores will be assigned the same unique number as the original core along with a suffix (e.g. A, B, etc for each additional drilling attempt).

- 4.13.14 Samples shall be processed and recorded (on-site or off-site) by the *Contractor's* suitably experienced geoarchaeologist to enable identification of archaeological remains, palaeoenvironmental content and potential. Cores judged by the environmental specialist to contain palaeoenvironmental indicators, cultural remains or suitable for dating shall be retained or sub-sampled from the sediment core.
- 4.13.15 Each (sub) sample shall be recorded with a unique sample record number, cross-referenced to a unique soil core sample number, and a written description of the processing record made on a standard environmental recording pro-forma. Any sample flots shall be recovered for further analysis at the discretion of the *Contractor's* environmental archaeologist. Sample residues shall be retained for further off-site processing if showing significant potential for further analysis.
- 4.13.16 A colour photographic record in digital format shall be made of the site survey works whilst they are in progress to graphically demonstrate each activity. Significant soil core samples shall be photographically recorded (in colour), prior to processing. These may include significant contacts revealed in the sample window or deposits containing significant palaeoenvironmental or cultural assemblages. All records shall be cross-referenced to the unique core sample number.
- 4.13.17 The *Contractor* shall provide a detailed methodology for the borehole investigations including specifying methodology to be utilised, sampling, storage and processing procedures to be adopted, following Historic England Geoarchaeology guidance This methodology will also outline the provision of support in the form of surveying, photography and implementation of health and safety systems.

4.14 Methodology for archaeological trial trench and test pit investigation

Criteria for relevance

- 4.14.1 Archaeological trial trench and test pit investigation are used to determine, as far as reasonably possible, the nature of the archaeological resource within a specified area. Like all forms of investigation they do however have limitations regarding the types of archaeological remains they identify and consequently their use must reflect the nature of the Specific Objectives of the GWSI: HERDS being addressed. The objective of the investigation is to gain information about the archaeological resource in order to support an assessment of its character, extent, knowledge value and ability to contribute to Specific Objectives. The outcomes of investigations may be used to inform the requirement and strategy of further archaeological investigation.
- 4.14.2 In both cases this comprises a limited programme of intrusive fieldwork to determine the presence or absence of archaeological features, structures, deposits, artefacts and/or ecofacts. Where present the investigation will define the character, extent, quality and

preservation of archaeology in order to determine its likely ability to contribute to Specific Objectives set out in the GWSI: HERDS.

Methodology

- 4.14.3 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.14.4 The location and objectives of the trial trench/test pit excavations will be set out in the Project Plan. Each trial trench will be assigned a unique ID in accordance with the *Employer's* Asset Information Management System (AIMS).
- 4.14.5 The dimensions of each trial excavation in plan shall be set out in the Project Plan, including the trench support system employed (if required) to secure personnel entry to the excavation. Trial excavations shall be excavated to a depth specified in the Project Plan, or until a specified sedimentary unit is encountered (e.g. underlying geology). This shall be dependent on the agreed objectives of the excavation.
- 4.14.6 The *Contractor* shall undertake hand excavation and cleaning of any archaeologically significant horizons, to fulfil the aims of the work. A sufficient sample of the archaeological features and deposits revealed must be sampled/or fully excavated to allow the resolution of the aims and objectives of the work. Structures, features, or finds which might reasonably be considered to merit preservation in-situ shall not be unduly damaged. The *Contractor* shall supervise the excavation of each test trench in such a manner so as to allow a cumulative or continuous section to be recorded
- 4.14.7 The *Contractor* shall ensure that water is discharged and excavated material from archaeological excavations are stored in accordance with the *Contractor's* environmental protection requirements (as set out in the package Works Information and their Environmental Management Plan) and any relevant consents for the worksite. The *Contractor* shall monitor discharge rates and, if necessary, conductivity of discharge waters to ensure compliance.

Archaeological trenching

- 4.14.8 Where areas of extensive archaeological stratification are encountered, the horizontal and vertical extent of archaeological stratification shall be assessed by the *Contractor* through implementation of an appropriate strategy including, either the excavation of features cut into horizontal stratification, limited test pitting or auguring. The aim shall be to recover suitable stratigraphic, finds and environmental samples from the full, intended depth of the trench, as far as is practicable. The exact methodology may need to be determined by the *Contractor* during the excavation of individual trenches and agreed with the *Employer*.
- 4.14.9 In order to protect any waterlogged remains during the works, the *Contractor* may identify a requirement for trial excavations to be allowed to refill with water overnight. In such cases, the *Contractor* shall ensure that any hazards to staff or 3rd parties are minimised.

- 4.14.10 Trial trenches and test pits shall be excavated to the first archaeological level or to a depth / other archaeological level specified in the Project Plan which shall be dependent on the agreed objectives of the investigation. Excavation will be undertaken using a mechanical excavator with toothless ditching bucket, except where the nature of the ground is such that an alternative bucket or means of breaking out prior to excavation is required (and the *Employer* has agreed an alternative method through the Project Plan).
- 4.14.11 Where modern foundations are likely to be present, the Project Plan shall identify whether they should be left in-situ for the purposes of the evaluation or removed. Where it is clear that modern foundations have truncated certain archaeological levels they should be removed to assess lower archaeological levels. The *Contractor* shall take all reasonable care to ensure that any damage to archaeological deposits is limited as far as practicable. If significant damage is likely to occur the work shall be suspended and the *Employer* informed so that a technical solution can be agreed with all parties.
- 4.14.12 Machining shall be carried out under the constant supervision of the *Contractor* to excavate the ground in spits. The *Contractor* shall use their professional judgement to determine the appropriate depth of each spit. Any variations to the excavation methodology shall be at the discretion of the *Contractor* and recorded in writing for inclusion in the final report to the *Employer*. Each spit shall be examined carefully to assist the recovery of any archaeologically significant artefacts and thus to determine when to cease machining. It is the responsibility of the *Contractor* to ensure that the finished surface is machined to a suitably 'clean' state in order to identify, define and investigate any exposed archaeological deposits. If the surface is not sufficiently clean, hand cleaning of the surface will be required. Machine excavation will comply with the *Employer's Technical Standard - Soil Handling for Land Restoration* (HS2-HS2-EV-STD-000-000008).
- 4.14.13 Metal detectors will be used by experienced staff to scan for metallic finds during the excavation of key archaeological features or deposits. The methodology for metal detector survey is provided in Section 4.7.
- 4.14.14 Within alluvial sequences the *Contractor* shall pay particular attention to establishing the vertical extent of layers of archaeological potential and shall be aware that horizons of cultural activity may be interdigitated with horizons of sterile alluvium. The *Contractor* shall supervise the excavation in such a manner so as to allow a cumulative or continuous section to be recorded.
- 4.14.15 In areas of deep stratigraphy, such as alluvial sequences, the evaluation trench shall be excavated to the base of the stratigraphic sequence, and shall be appropriately shored and kept free of water by the *Contractor* to allow 'person entry' to the excavations i.e. to allow the *Contractor* to undertake investigation and recording to fulfil the aims of the work. The *Contractor* will ensure that all works undertaken in deep stratigraphy will comply with the *Employer's Technical Standard – Temporary Works* (HS2-HS2-CV-STD-000-000005).

- 4.14.16 Should any material be excavated that is deemed to be contaminated or potentially contaminated it shall be investigated, controlled (e.g. placed separately from clean material) and removed from the site in accordance with the *Contractor's* environmental protection requirements (as set out in their Environmental Management Plan).

Backfilling

- 4.14.17 The trenches shall be pumped dry (by the *Contractor*) and any necessary protection measures for archaeological remains (in addition to those for below ground infrastructure, services or utilities) shall be completed prior to backfilling. Backfilling and reinstatement shall be undertaken as specified in the package works information and in accordance with the approved Project Plan / LS-WSI and *Contractor's* method statement or other instruction from the *Employer* and / or *Contractor*. Generally, all backfill material shall consist of non-toxic, uncontaminated, non-putrescible, natural and inert material which shall be compacted and (if necessary) tested (dynamic compaction test or other) in accordance with a specification provided by the *Contractor*. Surface conditions shall be reinstated to the required standard.
- 4.14.18 The *Contractor* shall ensure, in liaison with the *Employer* that adequate protection is provided for any archaeological remains. Any specific archaeological requirements relating to backfilling including use of materials to mark excavated depth, such as geotextiles, shall be specified by the *Contractor* in the Project Plan / LS-WSI.

4.15 Methodology for archaeological monitoring

Criteria for relevance

- 4.15.1 *A programme of archaeological monitoring (i.e. observation, investigation and recording) is carried out by the Contractor during site investigations (e.g. geotechnical test pits, boreholes and utilities trial trenches) and construction works.*
- 4.15.2 *The purpose is to identify the potential of any archaeological remains that are uncovered in the course of the works and record them appropriately (as far as is reasonably practicable). Archaeological monitoring should not be specified as a 'just-in-case' measure and archaeological monitoring shall only be specified where Specific Objectives set out in the GWSI: HERDS would be clearly addressed.*

Methodology

- 4.15.3 The *Contractor* shall undertake monitoring in areas of ground disturbance where such monitoring would address Specific Objectives in the GWSI: HERDS. This shall include any activities (including those associated with site set-up and demolition) undertaken by the *Contractor* that involve the removal of modern material, made ground and topsoil, subsoils, and superficial geological deposits such as alluvium and colluvium.
- 4.15.4 Areas that have been previously subject to archaeological excavation and which are known not to contain significant deposits (for example tunnels, cuttings, and areas of known large-

scale modern disturbance) shall not be monitored, unless otherwise stated. Areas that have been subject to previous assessment and evaluation (e.g. geophysical survey, surface artefact collection, geotechnical survey, trial trenching etc.) can be included within a monitoring exercise, where such monitoring would meet Specific Objectives.

- 4.15.5 During archaeological monitoring excavation will be undertaken using a mechanical excavator with toothless ditching bucket, except where the nature of the ground is such that an alternative bucket or means of breaking out prior to excavation is required (and HS2 has agreed an alternative method). It is the responsibility of the *Contractor* to ensure that the finished surface is machined to a suitably 'clean' state in order to identify, define and investigate any exposed archaeological deposits. If the surface is not sufficiently clean, hand cleaning of the surface will be required.

4.16 Methodology for construction integrated recording

Criteria for relevance

- 4.16.1 *Construction Integrated Recording should be used for areas of known occasional, dispersed features the investigation of which would meet Specific Objectives but where access prior to construction has not been possible due to a range of possible project factors.*

Methodology

- 4.16.2 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.16.3 The requirement for construction integrated recording may impose constraints on, or require changes to, the *Contractor's* method of working to enable the archaeological investigation to take place alongside construction works.
- 4.16.4 Except in cases where unexpected, potentially nationally important, archaeological remains are discovered, Construction Integrated Recording shall be designed and implemented so as to avoid adverse impact on the construction programme, wherever practicable. The *Contractor* shall make allowance in their activity programme for the completion of any Construction Integrated Recording exercises as set out in the Project Plans and LS-WSIs.
- 4.16.5 In areas where the need for Construction Integrated Recording has been identified the *Contractor* will strip soils (which may include modern made ground, topsoil, subsoil, alluvium and colluvium) using a 360 degree excavator and toothless ditching bucket under the archaeological supervision.
- 4.16.6 The *Contractor* will limit their tracking of vehicles and plant within areas specified in the LS-WSI and/or as instructed by the *Employer*. The *Contractor* will facilitate mapping and sampling of deposits through use of agreed plant, a site share agreement and careful liaison between the *Contractor* and their supply chain.
- 4.16.7 The Works to be carried out by the *Contractor* shall consist of two parts:
-

- Archaeological monitoring ('observation') following the progress of construction activities by a core team of archaeologists. Allowance must be made by the *Contractor* for investigation of archaeological remains and remains of quaternary geological importance if identified.
- Investigation of archaeology and remains of quaternary geological importance undertaken either:
 - by the core team, following the progress of construction activities; or
 - by additional archaeologists (the 'support team'), to be deployed to investigate unanticipated archaeological remains, where appropriate.

4.16.8 The *Contractor's* core team shall consist of appropriately experienced archaeologists commensurate with the scale and nature of the *Contractor's* works.

4.16.9 The core team shall undertake the observation and any required investigation such as they may reasonably be able to undertake.

4.16.10 The *Contractor's* support team shall consist of additional experienced archaeologists. The size of the support team shall be commensurate with the scale and programme of the *Contractor's* works.

4.16.11 The *Contractor's* core and support teams shall be advised where necessary by specialists, as appropriate and as agreed with the Employer.

4.16.12 The *Contractor* shall record the following observations on a daily basis. The record shall consist of, as a minimum:

- The site/trench codes as defined in the *Employer's* AIMS;
- the chainage/location of the area observed;
- the date(s) of the observation;
- personnel employed on site;
- a description of the construction works observed;
- the works (sub) contractor and personnel undertaking and supervising the construction activity;
- depths and extents of excavation works observed;
- measure of confidence that any archaeological remains would have been observed and reasons;
- the areas and horizons (both those containing archaeological or remains of quaternary geological importance and those which do not) unaffected by construction

activity (with special reference to archaeological sites identified for preservation in situ);

- the reasons why any particular area of the works was not observed, and noting those areas not subject to disturbance from construction;
- location and description of any archaeological remains; and
- location and description of any modern remains.

4.16.13 An appropriate sample, as specified in the Project Plan, shall be excavated from cut features and other archaeological remains of importance. Sampling of cut features shall include feature inter-sections to establish relative chronologies. Spoil tips will be surface inspected for artefacts and metal detected. The extent of sampling shall be determined by the *Contractor* in liaison with the *Employer*, through the Project Plan, but may, for instance, include the sample excavation of a selected number of deposits (both layers and negative, cut features), recording of structural remains, drawn sections and profiles, and/or be aimed at recovering sufficient information to determine function, form, and date. Any specific variations from this specification shall be indicated in the *Contractor's* method statement.

4.16.14 Heights for all deposits shall be related to approved HS2 Permanent Ground Markers (PGMs). Levelling accuracy between PGMs and site Temporary Bench Marks (TBMs) shall be within 10 mmik: where 'k' is the total distance levelled in kilometres.

4.16.15 It may not be possible to clean and record the archaeological profile of geotechnical test pits, due to health and safety or access constraints. Every effort shall be made to establish the presence or absence of archaeological deposits by establishing the absolute ordnance datum (AOD) for the height of significant deposits, including the depth of modern intrusions, key stratigraphic components and natural deposits.

4.16.16 During monitoring, excavation will be undertaken using a mechanical excavator with toothless ditching bucket, except where the nature of the ground is such that an alternative bucket or means of breaking out prior to excavation is required (and the *Employer* has agreed an alternative method). It is the responsibility of the *Contractor* to ensure that the finished surface is machined to a suitably 'clean' state in order to identify, define and investigate any exposed archaeological deposits. If the surface is not sufficiently clean, hand cleaning of the surface will be required.

4.17 Methodology for archaeological recording

Criteria of relevance

4.17.1 *Archaeological recording comprises a programme of intrusive fieldwork in order to examine and record the archaeological resource within a specified area for the purpose of addressing identified Specific Objectives in the GWSI: HERDS. All fieldwork will be undertaken with defined research objectives that are based upon the GWSI: HERDS. The investigation of the archaeological*

resource is intended to satisfy aims set out in the HERDS and to compile a research-led record of that resource, to analyse and interpret the results, and disseminate them as appropriate.

Methodology

- 4.17.2 Archaeological recording should be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS (section 7.3).

Mechanical excavation

- 4.17.3 All machining will be undertaken under supervision by the *Contractor* using a mechanical excavator with toothless ditching bucket, except where the nature of the ground is such that an alternative bucket or means of breaking out prior to excavation is required (and the *Employer* has agreed an alternative method).
- 4.17.4 All undifferentiated topsoil, or overburden of recent origin, shall be removed down to the first archaeological layer. An exception to this would be where a focused soil- sampling strategy is proposed to record and collect data from reworked soil contexts above recognisable stratified archaeological contexts. If a mechanical excavator is to be used to remove modern overburden, such as floor slabs or recent levelling layers, this shall be undertaken in spits dependant on specific site conditions, moving along the length of the trench or area. Each spit shall be examined carefully to assist the recovery of any archaeologically significant artefacts and thus to determine when to cease machining. The *Contractor* shall use their professional judgement to determine the appropriate depth of each spit. Any variations to the excavation methodology shall be at the discretion of the *Contractor* and recorded in writing for inclusion in the final report to the *Employer*. Machine excavation will comply with the *Employer's Technical Standard - Soil Handling for Land Restoration* (HS2-HS2-EV-STD-000-000008).
- 4.17.5 Where modern foundations are likely to be present, the Project Plan / LS-WSI shall identify whether they should be left in-situ for the purposes of the investigation or removed. Where it is clear that modern foundations have truncated certain archaeological levels they should be removed to assess lower archaeological levels. The *Contractor* shall take all reasonable care to ensure that any damage to archaeological deposits is limited as far as practicable. If significant damage is likely to occur the work shall be suspended and the *Employer* informed so that a technical solution can be agreed.
- 4.17.6 In areas of deep stratigraphy, such as alluvial sequences, each intervention shall be excavated to the base of the stratigraphic sequence, and shall be appropriately shored and kept free of water to allow 'person entry' to the excavations i.e. to allow the *Contractor* to undertake investigation and recording to fulfil the aims of the work. The *Contractor* will ensure that all works undertaken in deep stratigraphy will comply with the *Employer's Technical Standard – Temporary Works* (HS2-HS2-CV-STD-000-000005).
- 4.17.7 Within alluvial sequences the *Contractor* shall pay particular attention to establishing the vertical extent of layers of archaeological potential and shall be aware that horizons of cultural

activity may be interdigitated with horizons of sterile alluvium. The *Contractor* shall supervise the excavation of each test pit in such a manner so as to allow a cumulative or continuous section to be recorded.

- 4.17.8 Should any material be excavated that is deemed to be contaminated or potentially contaminated it shall be investigated, controlled (e.g. placed separately from clean material) and removed from the site in accordance with the Principal Contractor's environmental protection requirements (as set out in their Environmental Management Plan).

Fieldwork recording

- 4.17.9 The recording is to include, as a minimum:

- At least one representative section at (1:10 or 1:20 scale) of each evaluation trench, or area of excavation, from ground level to the base of the excavation;
- the written record of individual context descriptions on appropriate pro-forma;
- plans at appropriate scales (1:10, 1:20 or 1:50);
- single context planning should be used only if appropriate;
- photographs and other appropriate drawn and written records; and
- other sections, including the half-sections of individual layers or features shall be drawn as appropriate to 1:10 or 1:20.

- 4.17.10 A 'site location plan', indicating site north shall be prepared at 1:1250. Individual 'trench plans' or 'excavation area plans' at 1:200 (or 1:100) shall be prepared which show the location of archaeology investigated in relation to the investigation area. The location of site plans will be identified using OSGB co-ordinates.

- 4.17.11 Section drawings shall be located on the relevant plan and OSGB co-ordinates recorded. The locations of the PGM bench markers used and any site TBM shall also be indicated.

- 4.17.12 A record of the full extent in plan of all archaeological deposits as revealed in the investigation shall be made. These plans will normally be based on digital survey data (digital planning methods shall be agreed in advance with the *Employer*) supplemented where appropriate by hand drawn records on polyester based drawing film (at a scale of 1:10 or 1:20 unless otherwise agreed with the *Employer*). All hand drawn information shall be digitised (or preferably generated digitally in the first instance), and final deliverables will be supplied in an Esri format and adhere to standards set out in the *Employer's Cultural Heritage GIS Specification (HS2-HS2-GI-SPE-000-000004)* and the *Geographical Information System Standards (HS2-HS2-GI-STD-000-000002)*. Single context planning shall be used where complex stratigraphy is encountered.

- 4.17.13 A 'Harris matrix' stratification diagram shall be employed to record stratigraphic relationships (Harris *et al.* 1993) where appropriate. This record shall be compiled and fully checked by the Contractor during the course of the excavations. Spot dating shall be incorporated onto this diagram during the course of excavations.
- 4.17.14 Recording of structural evidence revealed below ground level will vary according to the level of special interest of the structure and its relationship to archaeological remains. Structures of little or no significance shall be noted on a site plan. Detailed drawings of important features revealed in investigations may be required in accordance with the aims and objectives of the investigation as defined in the Project Plan.
- 4.17.15 The *Contractor* shall agree the appropriate level of recording and analysis for discovered standing structures with the Employer through the Project Plan. The *Contractor* shall revise the method statement to reflect any additional requirements for built heritage recording.
- 4.17.16 The photographic record will be in digital format, resulting in high resolution TIFF (uncompressed) images. Photographs will illustrate both the detail and context of the principal archaeological features discovered. In addition, the *Contractor* shall take appropriate record photographs to illustrate work in progress. All photographic records will include information detailing: site name and number/code, date, context, scale and orientation.
- 4.17.17 Video recording may be appropriate in some circumstances and the *Contractor* shall set out proposals for such recording in the method statement for approval by the *Employer* through the Project Plan.
- 4.17.18 Where appropriate a photogrammetric record or laser scan record shall be made of complex structures, features and horizons, liable to be damaged in the course of the investigation, such as buildings or parts of buildings. Appropriate technical specification and scales shall be specified in the Project Plan and addressed in the *Contractor's* method statement.

4.18 Methodology for archaeological excavation of human burials

Criteria of relevance

- 4.18.1 *This methodology is appropriate to all excavations of human remains whether planned or the result of an unexpected discovery. Excavated human remains and their context, which can provide information regarding the rites of the burial, can be an important source of direct evidence about the past.*

Methodology

- 4.18.2 Archaeological recording shall be undertaken by the *Contractor* to the general requirements as described in the GWSI: HERDS.
- 4.18.3 Where human remains are identified, all subsequent work must be undertaken in accordance with the *Employer's Human remains and monuments procedure* (HS2-HS2-EV-PRO-000-000008).

- 4.18.4 The *Contractor* shall confirm how the requirements set out in the Project Plan will be implemented as part of their procedure for excavating and recording human remains in the *Contractor's* method statement.
- 4.18.5 At locations known to contain human burials, or that have a high potential for the presence of human remains, provision shall be made by the *Contractor* for site inspection by a suitably qualified osteo-archaeologist.
- 4.18.6 Should human remains be discovered, the *Contractor* shall notify the *Employer* immediately so that these procedures can be implemented. This notification may be initially made personally or by telephone but shall be confirmed in writing (including email) within 24 hours of discovery.
- 4.18.7 The *Contractor* will be required to cease all works at that location until further instruction is provided by the *Employer*. The *Contractor* shall undertake an initial in situ observation and assessment of the remains and shall advise the *Employer* of the course of action required.
- 4.18.8 Lifting of human skeletal remains shall be kept to the minimum which is compatible with an adequate evaluation or excavation, where the remains contribute to Specific Objectives and as required by the Project Plan.
- 4.18.9 Visible grave goods and other obvious artefacts, shall be recorded and lifted before the end of the working day to avoid the risk of vandalism and theft. Where this is not feasible or appropriate, the *Contractor* shall ensure, on liaison with the *Employer* that adequate site security is provided. As a minimum, this will require a 24 hour comprehensive security regime until sensitive remains have been recorded and lifted. This is a particular issue for rural sites and 'occasional burials'.

4.19 Methodology for historic building recording and salvage

Criteria of relevance

- 4.19.1 *Historic building recording is intended to address specific questions relating to specified buildings or complexes and their settings. A programme of survey and recording work should address Specific Objectives in the GWSI: HERDS. The recording of a historic building is intended to satisfy aims set out in the HERDS and, where appropriate, compile a lasting record of that resource, to analyse and interpret the results as appropriate.*
- 4.19.2 *Heritage Agreements for listed buildings in Table 1 of Schedule 18 require method statements to be submitted for approval that, where applicable, will set out the results of specialist assessments, a specification for investigation and recording and the provisions to be made during demolition for the salvage of material of architectural or historic significance which has the potential for re-use.*

- 4.19.3 *A Historic building recording will be used ahead of the alteration and demolition of a historic building where Specific Objectives in the GWSI: HERDS can be addressed. It may also be used to inform the conservation, repair or management of a building or complex and its setting.*
- 4.19.4 *Salvage and pre-demolition audits will be used prior to the demolition or alteration of a historic building to identify material of particular historic and/or architectural significance with the potential for re-use.*

Methodology

General considerations

- 4.19.5 Historic building recording shall be undertaken by the Contractor to the general requirements as described in the GWSI: HERDS.
- 4.19.6 Historic building recording will be carried out in line with the standard and guidance documents set out in the GWSI: HERDS. Historic building recording will comprise, to varying degrees of detail, a drawn record, a photographic record and a written record; and may also include documentary analysis and opening up works. The Project Plans will be required to expand upon the methodology outline below and the levels of recording outlined in Understanding Historic Building: A guide to good recording practice (Historic England, 2016) to produce a bespoke methodology. Specific elements of the methodology (and reporting) will aim to investigate the historic structure, building or complex of buildings in order to achieve Specific Objectives outlined by the GWSI: HERDS.
- 4.19.7 The historic building or structure identified for investigation should not be viewed in isolation, as they are rarely singular entities but more often an element of a wider cultural heritage context that includes associated structures and landscapes / townscapes. Therefore, the programme of investigation should, wherever appropriate to the objectives of the investigation, be developed in conjunction with other elements of recording such as historic landscape recording and the setting of heritage assets.
- 4.19.8 Historic building recording will be co-ordinated with the demolition contractor when necessary to enable, where required, the recording following the soft strip of interiors and recording during demolition.
- 4.19.9 Health and safety constraints could be of such a nature so as to preclude what would otherwise be the preferred or the most efficient programme of work; however, it is more likely that the identified constraints or risks can be mitigated through a well-designed scheme of work.
- 4.19.10 The salvage of fixtures and fittings can be a means of securing historic features which would otherwise be lost and advancing our understanding of the past by extending museum or other academic collections. There may also be instances where the details and fixtures are of particular significance to those associated with the design or historic use of the building

affected, for whom retention and reuse will enable an association with the historic building to be retained.

- 4.19.11 The recovery and reuse of fixtures and fittings or historic building materials can also assist in the restoration and repair of other period properties and can be a means by which historic buildings can be reflected in new developments.
- 4.19.12 The Construction Demolition and Excavation Waste Strategy (CDEWS) (HS2-HS2-EV-STR-000-000004) sets out the project's approach towards the minimisation and management of solid waste for all design and construction phases, including requirements in relation to the demolition of historic buildings and structures.
- 4.19.13 Salvage and pre-demolition audits of historic buildings and structures will be co-ordinated with the demolition contractor to ensure that a suitably qualified and competent professional experienced in historic building investigation and analysis is in attendance.

Detailed assessment (specialist assessment)

- 4.19.14 Further detailed assessment or 'Specialist Assessment' (see Historic England; Understanding Historic Buildings: Policy and Guidance, 2016) of a built heritage asset may be required to further develop an understanding of an asset's significance (for example its internal elements) or to provide additional information about its structure. Specialist assessment will principally be undertaken during the design development phase of the project, i.e. before Royal Assent or shortly thereafter.
- 4.19.15 Specialist assessment is likely to be required for those assets where further information, particularly concerning structure, is considered necessary to inform decisions regarding an appropriate programme of investigation to meet Specific Objectives.
- 4.19.16 Specialist assessment of the asset would almost always be required for those designated assets listed in table 1 or table 2 of Schedule 18 of the High Speed Rail (London - West Midlands) Act for which a heritage method statement is required as part of a Heritage Agreement.
- 4.19.17 The requirements of a specialist assessment will be specific to an individual asset but is likely to comprise documentary research, further site visit including internal inspection and potentially works of opening up (intrusive investigation). Further information on the scope and application of a specialist assessment is contained within Understanding Historic Buildings: Policy and Guidance (Historic England 2016, page 5).
- 4.19.18 The scope and purpose of the specialist assessment will be established in the Project Plan for the works.
- 4.19.19 The Project Plan may specify that a salvage audit is required as part of the specialist assessment to identify fixtures and fittings or other material of particular historic and/ or architectural significance with the potential for re-use.

4.19.20 The outcome of the specialist assessment will be used to inform the need for any further investigatory works and the scope and purpose of these works, all in relation to the Specific Objectives of the HERDS. The Specialist Assessment will therefore directly inform the Project Plan for further phases of works.

4.19.21 When addressing designated assets, the specialist assessment will be used to inform the heritage method statement for designated assets subject to a Heritage Agreement.

Site-based investigation

Building recording

4.19.22 Building investigation or recording will usually be carried out in advance of the main construction works. Building investigation or recording can be undertaken during enabling works. Building recording can also occur as part of the main construction works if there are reasons such as access or safety as to why they could not be undertaken in advance of the main works. A full programme of building investigation and recording may extend from enabling works and into main construction works again dependent on the level of access required.

4.19.23 The level of investigation will be primarily determined by the Specific Objectives being addressed; other factors warranting consideration include the significance of the asset, the extent of current knowledge regarding the asset or its type and the nature of the impact. For designated assets the level of investigation will be agreed through the Heritage Agreement.

4.19.24 Historic England (Understanding Historic buildings: A guide to good recording practice; 2016) has defined an approach to historic building recording identifying a range of techniques and providing guidance on when these may be applicable. The document builds upon and expands previous guidance on this matter published in 1996 (RCHME Recording Historic Buildings: A descriptive specification) in which specifications of 4 levels of recording (plus photographic survey) were proposed.

4.19.25 Descriptions of the 4 levels of recording, plus photographic study, and their specification is set out in section 5 of the Historic England document and summarised here in Table 2.

Table 2: Historic England levels of recording for historic building assessment works

Recording Level	Scope	Description
Level 1	Basic visual record	A minimal level of survey, usually of exteriors only and usually to inform further detailed work. Appropriate for a rapid gathering of information on a large number of assets. The emphasis is on a written description with some basic photography.
Level 2	Descriptive record	A higher level of descriptive survey when further works are not envisaged. The interior and exterior will be inspected and the written account will be accompanied by photographs and some drawing. The survey will enable a general statement of significance to be made.

Level 3	Analytical record	A systematic and analytical account of the building with analysis of documentary sources. This is a full inspection of the building with a full analytical written account accompanied by detailed drawing and photographs showing general and specific details of structure and décor allowing the origins and development of the building through time to be determined.
Level 4	Comprehensive analytical record	The highest level of recording particularly appropriate for buildings known to be of special importance. The survey will draw on the full range of available resources including intrusive opening work and materials sampling. This is a comprehensive and full analysis of the building, its origins and development with a detailed written account illustrated and supported by extensive drawings and photographs.
Photographic Survey	Visual record	A full and detailed photographic record supported by a brief written account. A photographic record would be an appropriate level of survey to document schemes of interior décor, fittings and fixtures.

- 4.19.26 Setting is not an asset nor is it a heritage designation¹, it is a concept and as such cannot be recorded in its own right. However, the setting of an asset can be a contributory factor to the significance or appreciation of the asset. A separate Technical Standard relating to the Recording of Setting has been prepared and should be addressed when developing Project Plans for works relating to built heritage assets.
- 4.19.27 In defining the levels of recording the Historic England guidance provides advice to determine within each level, the degree of detailed works i.e. in deciding whether to provide a full drawn survey or to simply drawings showing particular aspects of a building's fabric, or whether to undertake primary documentary research or simply to collate readily available published sources. In all instances the Project Plan should detail the particular requirements of work to be required within a defined level of survey. The proposed scope of works must be proportionate to the requirements of the Specific Objectives being met.
- 4.19.28 Where fixtures and fittings or other material of particular historic and/ or architectural significance with the potential for re-use are identified through the specialist assessment, options for re-use should be reviewed and an appropriate recipient identified and confirmed. A methodology for the salvage of the material and its reuse would be set out in a Project Plan or method statement (listed building), which would include details of how the material will be removed, stored and transported to its destination.

Techniques of building investigation

- 4.19.29 Consideration should always be given to the full range of investigative techniques available. In considering whether or not a particular technology would be appropriate factors including efficiency and ease of use, accuracy and reliability of result and cost effectiveness should be taken into account. For instance a full 3D laser scan of a complex building or structure will not

¹ Historic England, 2015, The Setting of Heritage Assets, page 4.

only be dimensionally accurate but could also be both more cost effective and easier to employ as compared to other remote surveying techniques or even hand survey.

- 4.19.30 The end use and end user will also be important contributory factors in determining any given technology. The Project Plan should consider the potential for both public and professional or academic publication of results which may dictate for example, the use of professional site photography to capture something other than simply the detail of fabric.
- 4.19.31 Examples of technologies that it may be appropriate to consider in determining the scope of the Project Plan are provided in Table 3.

Table 3: Technologies to be considered in determining the scope of Project Plans

Technology	Brief description	Application
3D laser scan	Laser imaging and capture of cloud point data enabling production of detailed digital images that can be rendered into an inter-active 3D representation of the structure	This can often be a rapid form of data capture suited to complex structures and ornate interiors and particularly suitable for preparation of a walk through interpretation or analysis of the structure
Remote sensing	A variety of remote sensing techniques can be applied to determine sub surface and buried features, including within upstanding walls blocked openings or obscured paintings.	The technology is non-invasive and can be used at the assessment stage to identify the potential for obscured fabric and so assist in consideration of both significance and in determining a scope for investigation.
Photographic enhancement	Photographic techniques making use of infra-red technology or enhanced light and coloured filters	The use of enhanced field photography and laboratory enhancement of images can assist in the identification of obscured or over painted features or other surface characteristics that are difficult to discern by the naked eye or conventional photography.
Materials sampling, finishes	Sampling and detailed examination of wall papers, paint analysis, mortar or plaster analysis can provide further detailed information in relation to the source of materials, chronology and comparables.	Paint and materials analysis is used in determining the makeup of finishes to assist both in a detailed understanding of the building as well as assisting in accurate repair and restoration. Wallpaper and analysis of other soft furnishings can provide information on source material, stylistic influences, manufacture and date and provide a detailed understanding of chronology and evolution of interior décor through time.
Dendrochronology and analysis of other building material	Materials analysis provide a forensic basis for determining composition and in the case of dendrochronology a method for the dating of timbers	Forensic analysis of building materials provides detailed information in relation dating of structures and structural components and the origins of materials.

Construction integrated recording

- 4.19.32 In some cases a programme of investigation and recording of buildings can be undertaken during construction / demolition activities. Investigative works at this stage of the project programme will only be undertaken in specific cases where the likely extent and potential for further information in respect of the Specific Objectives being addressed and the significance, date or structural development of the building has been demonstrated but where detailed investigation prior to the main construction programme is impracticable or inappropriate e.g. due to safety or logistical considerations or engineering constraints such as the need for structural elements to be removed to allow detailed observation. The main contractors preferred method of working would be controlled as necessary to allow the recording to take place to the required standard.

Salvage

- 4.19.33 If the salvage of building material is determined to be feasible and a suitable depository has been confirmed, a methodology for the deconstruction of the building will need to be prepared as part of the demolition contract and specification for the demolition work written into the demolition method statement for the historic building.
- 4.19.34 The outcomes of the salvage and pre-demolition audits will be reported in the Resource Management Plan (RMP) for each site in accordance with the Construction Demolition and Excavation Waste Strategy (HS2-HS2-EV-STR-000-000004). The outcomes of pre-demolition audits will also be shared with the design team to enable them to identify opportunities for on-site recovery.

4.20 Methodology for historic landscape recording

Criteria of relevance

- 4.20.1 *The construction of HS2 will change a diverse and disparate range of landscapes and townscapes, not all of which possess heritage significance and not all will be defined as heritage assets. Therefore, identifying a prescriptive geographical scale, or study area, for the programme of historic landscape recording will be a critical component of the scope.*
- 4.20.2 *Historic Landscape recording is intended to provide a record of a specified area of landscape to address Specific Objectives set out in the HERDS.*
- 4.20.3 *It is likely that the scope of investigation and thus the required recording techniques to be employed will vary for each Project Plan. At one end of the spectrum it is possible that the scope defined within a Project Plan could be restricted to the investigation of a single 'element' of the historic landscape such as a hedgerow; earthworks of ridges and furrows; a pond or pool; a wall or other item of street furniture. However, at the other end of the spectrum a Project Plan could be required to define a programme of recording that seeks to investigate a complex historic landscape. The GWSI: HERDS will identify the Specific Objectives that should be addressed by investigations.*

4.20.4 *Historic landscape recording may also be used to inform the conservation and management of a landscape and its setting.*

Methodology

4.20.5 The Project Plan may comprise a suite of techniques appropriate to the location. Consideration should be had to devising a holistic scheme of investigation. Programmes for historic landscape investigation should also consider historic building recording and recording setting.

4.20.6 The Project Plans should utilise Understanding the Archaeology of Landscapes: A guide to good recording practice (English Heritage, 2007) and Assessing the effects of road schemes on historic landscape character (Highways Agency, 2007) to develop the detailed methodologies. This will comprise, to varying degrees of detail surveys supported by a drawn record, background archival analysis, a photographic record and a written analysis. The methodology will be required to expand upon the three levels of recording, set out in Understanding the Archaeology of Landscapes, as appropriate to produce a bespoke methodology that addressed Specific Objectives in the GWSI: HERDS.

4.20.7 The techniques of recording are likely to comprise, but not be limited to, the following elements:

- desk-based research drawing from primary sources such as documentary, cartographic, historic air photos and Lidar; and secondary sources such as local authority maintained historic landscape characterisation data sets and other information held on the historic environment records (see *Specification for detailed desk based assessment* above section 3).
- site investigations such as topographic and earthwork surveys, photographic and drawn records (see above).

4.20.8 Direction on the recording methodology can be found in the following Historic England guidance: *Understanding Place, Historic Area Assessments: Principles and Practice* (2010) which sets out the principles and guidance for historic area assessments; *Where on earth are we?* (2005) which details the use of GNSS in field survey; *Traversing the Past* (2011) on the use of the total station theodolites (TST) in landscape archaeology; and *The Light Fantastic* (2010) on the use of Lidar in archaeology survey.

4.20.9 Table 4 (adapted from Historic England 2007) provides the standard terminology to ensure consistency across the Project Plans.

Table 4: Glossary of terms (from Historic England 2007)

Authenticity	The condition of assets where the constituents and their arrangement are as originally intended.
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Technical Standard - Specification for historic environment investigations

Document no.: HS2-HS2-EV-STD-000-000035

Revision: Po4

Capacity to Absorb Change	The capacity of an historic landscape character unit to be altered without fundamentally altering its historic character.
Coherence	The integration and interrelationships (temporal, spatial or functional) of aspects and values of historic landscape character.
Component	Larger agglomerations of parcels such as dispersed settlements or straight sided field systems. These combine to form historic landscape types
Conservation	The process of managing change to sustain the significance of inherited historic assets, for current and future use and enjoyment
Cultural Association	Significant reference to or representation of an historic landscape in literature, art, poetry, song etc ie the creation of values in an area of landscape by activities, depictions etc.
Distinctiveness	The combination of characteristics (in this context historic ones) that allow one area to be distinguished from another.
Element	The smallest item(s) of an historic landscape that contributes to its significance. Examples include a hedge, lawn, specimen plant, house, meadow or open field, fence, wall, earthwork, pond or pool, bollard, orchard etc. They combine to form parcels.
Fragility	Measure of the ability of a historic landscape character type to accept change (see sensitivity)
Fragmentation	The process of disaggregating historic landscape types into components separated by non-significant later elements.
Historic Landscape	Historic landscape is an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (European Landscape Convention, Council of Europe 2000). Historic landscape is defined by perceptions that emphasise the evidence of past human activities in the present landscape.
Integrity	Where the various aspects of an area's character can be perceived as forming a more or less consistent whole, eg (but not exclusively) deriving from one period, or reflecting one set of historic processes.
Legibility	The degree to which (and the manner in which) the past can be seen, appreciated and understood in the landscape. Legibility is perceptual, relying on the ability to 'read' the historic significance of surviving landscape features.
Maintenance	Routine work necessary to keep the fabric of historic assets in their existing condition, preventing or inhibiting the development of decay, but not involving repair.
Parcel	Elements combined to produce, for example, farmsteads or field. These combine to form components
Preservation	Actions to halt or slow the deterioration of assets that would otherwise continue. It entails the avoidance, as far as possible, of physical interference, so that original materials are retained intact and untouched in situ (a special case – "preservation by record"– refers to the removal of the asset, reporting analysis publication of the results by archaeologists). Preservation can be achieved through maintenance or repair.
Rarity	The frequency of occurrence of a particular set of attributes. Although all historic landscapes are by definition unique, certain character types may be repeated within a region or nationally giving rise to a measure of rarity.

4.21 Methodology for archaeological science

Criteria of relevance

- 4.21.1 *Archaeological science forms part of the post excavation procedure to analyse evidence recovered during archaeological investigation. Scientific analysis is used to interpret the evidence recovered to help improve our understanding of a location. The interpretation can be used to inform the scope of further investigation and will feed into the final record or the site.*
- 4.21.2 *The appropriate techniques will be based upon the type of evidence recovered, the context of the site and the Specific Objectives of the GWSI: HERDS.*

Methodology

- 4.21.3 The strategy for sampling archaeological and palaeoenvironmental deposits and structures (for example soils, timbers, pollen, diatoms and animal bone) will be developed by the *Contractor*.
- 4.21.4 On-site work and off-site analysis of the processed samples and remains will be undertaken by the *Contractor's* environmental archaeologist as specified in the *Contractor's* method statement. The collection and retention strategy will be set out in the Project Plan and LS-WSI and will comply with the Historic Environment Physical Archive Strategy and Procedure (HS2-HS2-EV-STR-000-000019 and HS2-HS2-EV-STD-000-000039).
- 4.21.5 Where preservation in situ is a viable option and investigations would not contribute significantly to the Specific Objectives set out in the GWSI: HERDS, consideration shall be given to minimising the possible effects of compression and loading on the physical integrity of the site and any hydrological or chemical impacts of the proposed construction works. Recommendations within Historic England guidance on Preserving Archaeological Remains should be reviewed and their applicability explored for the particular circumstances.

Scientific dating

- 4.21.6 In order to deliver the GWSI: HERDS, the Contractor shall ensure that an appropriate specialist in scientific dating techniques co-ordinates the review, submission, statistical analysis and reporting of results of all scientific dating is part of the Contractor supply chain. The appointed specialist shall also be suitably experienced in chronological modelling. The *Employer* shall maintain oversight to ensure consistency and to disseminate the results and lessons learnt with the other Contractors.
- 4.21.7 At all stages the programme of archaeological work will need to be led by the potential of any historic environment remains to address the Specific Objectives in the GWSI: HERDS.
- 4.21.8 As part of the assessment phase there may be a requirement to establish the date of a particular feature. Decisions over the required chronological precision will be determined, in

the first instance, by the interpretation requirement which in turn will reflect the Specific Objectives being addressed by the activity; e.g. simple phasing (e.g. determining if a feature is prehistoric or not) or more complex questions over site development (e.g. period-specific chronological questions requiring multiple dates to enable the use of Bayesian modelling to constrain the age-range).

- 4.21.9 From the outset an iterative approach to sample selection and chronological modelling will be implemented. Where sites of known archaeological potential are to be encountered, the dating specialist should undertake a review of any existent dating to identify why dating for the site, on-site activity, or encountered artefacts, may be required, the quality of the existent dating evidence, and the required dating precision to address site-specific questions, all based on the Specific Objectives within the GWSI: HERDS being addressed by the works.
- 4.21.10 The early identification of dating potential at a site, and techniques available, will permit modifications to sample strategy to be made. A suitably trained dating specialist should be available to provide advice to the *Contractor* on the suitability of such techniques for each site under investigations.
- 4.21.11 Some dating techniques may require a specialist to undertake a site visit in order to perform on-site measurements and the sampling itself (e.g. Optically Stimulated Luminescence dating). Available advice for dating should be followed see Historic England guidance on scientific dating (e.g English Heritage, Archaeomagnetic Dating, English Heritage, Luminescence Dating; English Heritage, Dendrochronology).
- 4.21.12 A wide range of proven dating techniques are available, including, but not limited to, radiocarbon, luminescence, amino acid racemization (AAR), archaeomagnetics and short-lived radioisotopes.
- 4.21.13 Where relevant to the investigation and the Specific Objectives being addressed, each Project Plan should specific a dating strategy to identify which samples should be selected, the methods to be deployed, and number of samples required. This will also consider the range of potential Specific Objectives in GWSI: HERDS that a dating programme could address.
- 4.21.14 The most frequently utilised dating method will be radiocarbon dating. For radiocarbon dating all material should be collected, packaged, and stored in a way that does not compromise its potential for radiocarbon dating.
- 4.21.15 Where radiocarbon dating of pre-Holocene samples is likely to be undertaken, the relevant dating specialist will notify the radiocarbon laboratory prior to sample submission to enable discussions over the best method(s) (including sample preparation and counting time) to adopt. Samples for absolute dating shall be submitted promptly to the supply laboratory proposed by the relevant dating specialist as agreed and instructed by the *Employer*. Delivery times shall be agreed to ensure that the results are available to aid development of specifications for subsequent archaeological investigation strategies in the Project Plans and LS-WSIs.

Generic specification for environmental sampling and analysis

- 4.21.16 At the project outset a sampling strategy for environmental sampling will be produced for each area of investigation, this will be outlined in the Project Plan. The strategy will outline the environmental research aims and objectives that are hoped to be addressed for each site investigation (within the limits of what is known about a site prior to excavation) and will be guided by the HERDS Specific Objectives. Advice should be sought from appropriate specialist at the outset of a Project Plan to ensure that the required sampling will be implemented on site, as well as agreeing assessment (and reporting) methodologies for each specialism to be employed during the project (including scheme-wide agreement if multiple specialists are to be used for the same technique). These aims and objectives will determine the types of sample taken, types of context sampled, density of sampling and sample size (see Historic England Environmental Archaeology guidance. Where a two-stage evaluation and excavation strategy is undertaken, the sampling strategy will be modified for the main excavation stage as new aims and objectives are defined during the evaluation stage.
- 4.21.17 Where required to meet the Specific Objectives being addressed by the investigation, appropriate features and deposits shall be sampled to retrieve palaeoenvironmental and economic indicators. The *Contractor* shall make provision for the sampling of a wide range of contexts for potential assessment and analysis for plant and animal micro/macro fossils and soils/sediments in order to fulfil the aims set out in the relevant Project Plan.
- 4.21.18 The *Contractor* shall use ten litre plastic buckets (with lids and handles), or strong polythene bags (double bagged) secured at the neck, for the recovery of bulk 'disturbed' environmental samples. An adhesive label recording the project event code, context number and sample information shall be securely fixed to a vertical face of the bucket only or attached to the neck of the bag. Labels shall be completed with an indelible ink pen. A duplicate non-adhesive label shall be inserted within the bucket or between the polythene bags. Alternative methods such as the use of bar codes / Q-codes will be considered by the *Employer* on a case-by-case basis.
- 4.21.19 The need for and focus of sampling will be determined by the Specific Objectives the investigation is seeking to address. The selection, preparation for and methods of taking samples together with their size, presentation and processing shall be in accordance with current best practice (e.g. ClfA 2014; Historic England guidance on Environmental Archaeology, Geoarchaeology).
- 4.21.20 The *Contractor* shall be responsible for the protection of all samples and finds and for their transport (including loading and unloading) to the processing facilities or other location as agreed with the *Employer*. Bulk samples shall be protected at all times from temperatures below 5°C and above 25°C and from wetting and drying out due to weather exposure.
- 4.21.21 For non-waterlogged deposits bulk samples shall normally be in the range of 40-60 litres. Where contexts have a volume of less than that stated above then 100% of the context should be sampled. Each bulk sample should only contain sediment derived from a single context.

Samples in the size range of 10-20 litres will be suitable for the recovery of macrofossils from waterlogged deposits.

- 4.21.22 The *Contractor* shall use appropriately sized monolith or kubiena boxes for the recovery of 'undisturbed' monolith samples for specialist analyses such as soil micromorphology and to sub-sample for microfossils (e.g. pollen and spores, diatoms, ostracods). Adjacent to each kubiena box, bulk samples of 50-100g should be taken to provide additional material for specialist analyses such as loss-on-ignition, magnetic susceptibility, soil phosphate analysis etc. Alternatively, this could be sampled as a second monolith / kubiena box.
- 4.21.23 Care shall be taken to ensure that wherever possible only newly exposed sections are sampled to avoid contamination, desiccation and decalcification. This sampling shall be undertaken under supervision of the *Contractor's* environmental specialist. Boxes shall be wrapped neatly and tightly in bin-liners or plastic sacks and secured with rubber bands. A label shall be attached to the outside (in duplicate) with site name and code, feature/context number and depths of sample.
- 4.21.24 The *Contractor* shall record the depth of the 'undisturbed' monolith at the top and the bottom of the sample. There shall be a 50mm overlap between each monolith. This information shall be plotted onto a section drawing at an appropriate scale, with all levels reduced to heights relative to Ordnance Datum. Monoliths should be taken to ensure that context boundaries are sampled and these should be noted on the sample recording pro-forma.
- 4.21.25 Where it is not possible to insert monolith boxes, the *Contractor* shall take a vertical series of small 'spot' samples. Samples shall be at 20mm vertical intervals with no more than 10mm depth being sampled. In the case of deposits with a low organic content it may be necessary to take as much as 5g or even 20g per sample. If so, sampling shall be extended laterally at a given depth in 10mm deep spits.
- 4.21.26 Where appropriate, the *Contractor* shall take contiguous column samples for the retrieval of macrofossils (e.g. molluscs, plant remains and insects). The individual sub-samples will be of 1-10kg, depending on the nature of the deposit and the category of material to be retrieved. Where several specialists are involved it may be necessary to take separate subsamples for a range of palaeoenvironmental evidence, for example, insects, molluscs and waterlogged plant remains, to ensure that adequate sub-samples are available for specialist assessment.
- 4.21.27 Processing of all bulk samples should be completed within two weeks of collection. The preservation state, density and significance of material retrieved shall be assessed by the *Contractor's* recognised specialist. Special consideration shall be given to any evidence for recent changes in preservation conditions that may have been caused by alterations in the site environment. Specialist samples for laboratory processing should be collected by, or sent to, specialists as soon as possible. Specialist samples should be labelled, wrapped and well-sealed as soon as sampled and should be kept chilled and in the dark (see Historic England

Environmental Archaeology for further guidance on processing and storage of environmental samples).

- 4.21.28 Where necessary to address Specific Objectives, animal bone assemblages, shall be assessed by the *Contractor's* specialist with reference to Historic England guidance (English Heritage, Animal Bones and Archaeology). When employed, other palaeoenvironmental techniques, such as, but not limited to, pollen, insects, molluscs, ostracoda, diatoms and charcoal should follow standard methodologies (in Historic England, Environmental Archaeology guidance) and adopt recognised standards in procedure (at both assessment and analysis stages) and agreed nomenclatures, especially where multiple specialists might be used during the life of the project. These procedures, including the minimum levels of assessment and analysis, should be defined by the *Contractor* in the Project Plan. Engagement with the regional science advisor(s) can help to identify the suitability of such techniques at an early stage in the investigation process.

Metallic objects and residues

- 4.21.29 Where works are intended to address Specific Objectives relating to industrial activity and there is evidence for industrial activity, macroscopic technological residues (or a sample of them) shall be collected by hand. Separate samples (c. 10ml) shall be collected for micro-slugs (hammer-scale and spherical droplets). Reference should be made to Historic England guidance on Archaeometallurgy. Assessment of any technological residues shall be undertaken. Assessment of finds assemblages shall, where appropriate to the Specific Objectives being addressed, include x-radiography of all iron objects (after initial screening to exclude obviously recent debris) and, where appropriate, nonferrous artefacts (including all coins). Where necessary, active stabilisation / consolidation shall be carried out to ensure long-term survival of the material, but with due consideration to possible future investigations.

5 References

CiFA (2014). *Standard and guidance for the collection, documentation, conservation and research of archaeological materials*. Reading: The Chartered Institute for Archaeologists

Harris, E. C., Brown M. R. and Brown G. J. (1993) *Practices of Archaeological Stratigraphy*. London: Academic Press Limited.

Highways Agency (2007) *Assessing the effects of road schemes on historic landscape character*

Gribble, J. and Leather, S. (2011). *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*. Commissioned by COWRIE Ltd (project reference GEOARCH-09)

Lark, R.M., Mathers, S.J., Thorpe, S., Arkley, S.L.B., Morgan, D.J. and Lawrence, D.J.D. (2013). A statistical assessment of the uncertainty in a 3-D geological framework model. *Proceedings of the Geologists' Association* 124 (6), 946-958. [doi:10.1016/j.pgeola.2013.01.005](https://doi.org/10.1016/j.pgeola.2013.01.005)

RICS (2014) *Measured surveys of land, buildings and utilities RICS Guidance Note (3rd Edition)*

Appendix A - Archaeological period date ranges

Prehistoric (500000BC to AD43)

- Palaeolithic (500000BC to 10000BC): Lower Palaeolithic (500000BC to 150000BC), Middle Palaeolithic (150000BC to 40000BC), Upper Palaeolithic (40000BC to 10000BC).
- Mesolithic (10000BC to 4000BC): Early Mesolithic (10000BC to 7000BC), Late Mesolithic (7000BC to 4000BC).
- Neolithic (-4000BC to -2200BC): Early Neolithic (4000BC to 3300BC), Middle Neolithic (3300BC to 2900BC), Late Neolithic (2900BC to 2200BC).
- Bronze Age (2600BC to 700BC): Early Bronze Age (2600BC to 1600BC), Middle Bronze Age (1600BC to 1200BC), Late Bronze Age (1200BC to 700BC)
- Iron Age (800BC to AD43), Early Iron Age (800BC to 300BC), Middle Iron Age (300BC to 100BC), Late Iron Age (100BC to AD43).
- Roman (AD43 to AD410)
- Early medieval (AD410 to AD1066)
- Medieval (AD1066 to AD1540)
- Post medieval (AD1540 to AD1901)
- Modern (AD1901 to present)

Appendix B – Historic Environment technical standards

Title	Reference	Description
Heritage Consents Strategy	HS2-HS2-EV-STR-000-000008	The purpose of this strategy is to ensure that all heritage consents required for the construction of HS2 are obtained on time, in order to avoid programme delays, and to ensure that the <i>Employer</i> meets the commitments made by the Secretary of State to the historic environment, as set out in the Heritage Memorandum.
Burial Grounds, Human Remains and Monuments procedure	HS2-HS2-EV-PRO-000-000008.	The procedure set out in this document is designed to cover all potential circumstances relating to the discovery of human remains (e.g. burials, cremations or disarticulated human bone) and associated monuments (e.g. gravestones) which may occur during the design and construction of HS2. The procedure sets out the mechanisms to be employed by all parties involved, with roles and responsibilities defined. This procedure will be implemented during any groundworks (including investigatory works) associated with the HS2 land take as defined by the Act. Outside the areas covered by the HS2 Act, the normal procedures for the removal of human remains using, for example section 25 of the 1857 Burial Act, or ecclesiastical law or any other relevant legislation should be implemented.
Procedure for the unexpected discovery of archaeological remains of potential national importance	HS2-HS2-EV-PRO-000-000009	The procedure set out in this document is to be followed in the event of the discovery, during the construction of HS2 Phase One, of unexpected archaeological remains which are considered to be of potential national importance. This procedure provides information on the required response to such a discovery, along with the mechanisms, notification requirements and procedures to be employed by all parties involved. The procedure will allow the formulation of an appropriate, intelligent response tailored to the specific assets discovered. This procedure will be implemented during any groundworks (including investigatory works) associated with the HS2 landtake as defined by the Act.
Technical Standard: Archaeology and built heritage approach to geotechnical investigation	HS2-HS2-EV-STD-000-000038	This document details the methodologies to be adopted for archaeological and listed buildings watching briefs for those locations where ground investigations are to be undertaken for engineering purposes to inform the detailed design.

Technical Standard - Specification for historic environment investigations

Document no.: HS2-HS2-EV-STD-000-000035

Revision: Po4

Title	Reference	Description
Technical Standard: Specification for historic environment investigations	HS2-HS2-EV-STD-000-000035	This specification provides the standards and minimum requirements for each type of historic environment investigation expected to be undertaken as part of the HS2 Phase One programme. The specification includes standards which are applicable to all historic environment investigations, in addition to specialist methodologies for individual archaeological investigation techniques. It also contains guidance on the reporting to be undertaken throughout a historic environment investigation. This document is to be used in the production of each project plan and LSWSI.
Technical Standard: Specification for Project Plans and Location-Specific Written Schemes of Investigation	HS2-HS2-EV-STD-000-000036	This specification describes the process for preparing project plans and LSWSIs for historic environment activities associated with HS2 Phase One. The document sets out the objectives and standards required for the preparation of project plans LSWSIs and sets out a consistent approach to scope, standards and report structure. This specification will ensure that all project plans LSWSIs are consistent across Phase One of HS2.
Technical Standard: Recording of the Setting of Heritage Assets	HS2-HS2-EV-STD-000-000037	This technical standard sets out the method for recording the setting of certain classes of designated heritage assets; specifically, listed buildings, historic battlefields, registered parks and gardens, and conservation areas. It also addresses circumstances where HS2 Phase One works occur within the boundaries of a conservation area, and would therefore have the potential to alter its character and appearance, rather than its setting. The document provides the decision making criteria for determining whether the recording of setting is required, at what level recording should be undertaken and the methodology to be used.
Technical Standard: Historic Environment Physical Archive Procedure	HS2-HS2-EV-STD-000-000039	This document provides the procedures and guidance for the creation and curation of the physical archive compiled as a result of the historic environment works conducted in connection with the HS2 Phase One scheme. These procedures are intended for use during all phases of the historic environment works.
Technical Standard: Historic Environment Digital Data Management and Archiving Procedure	HS2-HS2-EV-STD-000-000040	This document provides the procedures and guidance for the creation and curation of the digital archive compiled as a result of the historic environment works conducted in connection with the HS2 Phase One scheme. These procedures are intended for use during all phases of the historic environment works.

