



## C807 - Wallasea Island - Archaeology Site Specific Written Scheme of Investigation for the Cell Breaching

**Document Number: C807-XRL-T1-XWI-CRT00\_ES001-50001**

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## 1 Executive Summary

- 1.1.1 This document forms a Site-Specific Written Scheme of Investigation (SS-WSI), for the Cell 1 Breaching Works at Wallasea Island as part of the Crossrail development. This SS-WSI supersedes those versions previously prepared by the C122 Framework Design Consultant (Document No. *C122-OVE-T1-RGN-CR039-50001* Revision. 2.0).
- 1.1.2 The site had until recently comprised low lying agricultural land enclosed by a sea wall flood defence. An archaeological assessment prepared for the RSPB and presented as part of the Wallasea Island Wild Coast Project Environmental Impact Assessment has identified the archaeological potential for the survival of archaeological remains associated with medieval or earlier sea walls. The remains of any earlier structures may survive within or beneath the existing flood defences in the form of timber revetments or posts, stone retaining walls or earthen banks.
- 1.1.3 The works at Wallasea Island are enabling spoil from Crossrail tunnelling activities in London to be distributed across areas of former farmland to create a wetland area as part of the RSPB's landmark Wallasea Island Wild Coast project. Crossrail is constructing the Cell 1 (a tidal lagoon) of the scheme by constructing new bunds, embankment and river channels.
- 1.1.4 The new landform of Cell 1 cannot be completed until it is connected to the local river system allowing it to flood with each tide. The connection will be made by breaching the existing flood embankment bordering the River Roach. The breaching works will require the excavation and removal of a section of the existing sea wall at three locations.
- 1.1.5 To mitigate the impact of the breaching works on the archaeological resource an archaeological general watching brief will be undertaken immediately after the breaching to identify and record any evidence for medieval or earlier sea walls.

## 2 Project Background

### 2.1 Introduction

- 2.1.1 Crossrail is a new cross-London rail link project which will provide transport routes across the southeast of England and London. The line will provide a range of both new and improved rail journeys across London and its immediate surroundings. The proposed development will include the construction of seven stations within central London which will have interchange with other public transport modes including the London Underground, National Rail and the London Bus service; the development will also include the renewal and/or upgrade of existing stations outside central London. The route itself will link Reading and Heathrow in the west with Shenfield in the north-east and Abbey Wood in the south-east.
- 2.1.2 The works at Wallasea Island are enabling spoil from Crossrail tunnelling activities in London to be distributed to land and areas of marshland to create a wetland area as part of the RSPB's landmark Wallasea Island Wild Coast project. Crossrail is constructing the Cell 1 (a tidal lagoon) of the scheme by constructing new bunds, embankment and river channels.
- 2.1.3 The new landform of Cell 1 cannot be completed until it is connected to the local river system allowing it to flood with each tide. The connection will be made by breaching the existing flood embankment bordering the River Roach at three locations (BNVO 2015).
- 2.1.4 The overall framework within which archaeological work will be undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail. Accordingly the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before construction work begins.
- 2.1.5 The strategy for archaeological works is set out in the Crossrail Generic Written Scheme of Investigation (WSI) (Crossrail 2008a, Document No. CR-XRL-T1-GST-CR001-00003). The Generic WSI presents the strategy for archaeology design, evaluation, mitigation, analysis, dissemination and archive deposition that will be adopted for the design and construction of Crossrail and provides a general statement of objectives, standards, and structure for the planning and implementation of archaeological works.
- 2.1.6 This Site-Specific Written Scheme of Investigation (SS-WSI) addresses archaeological works required during sea wall breaching undertaken for the C807 Marine Transportation and Wallasea Island Earthworks. This SS-WSI has been revised to specifically address the updated construction methodology and programme required to deliver the C807 contract. Consequently this document supersedes the previous SS-WSI prepared by C122 (Document No. C122-OVE-T1-RGN-CR039-50001 Revision. 2.0).

### 2.2 Site Description

- 2.2.1 Wallasea Island lies approximately 12km North East of Southend-on-Sea at National Grid Reference TQ965935 (Figure 1) and is one of six islands (with Potton, Rushley, Foulness, New England and Havengore) which form the Essex Archipelago located on the southeast coast of the county.

- 2.2.2 The island is defined by the River Crouch to the north and the River Roach which flows from its confluence with the Crouch southwards before turning west to define the eastern and southern limits of Wallasea. The western side of the island is defined by the Lion Creek, Paglesham Creek and Paglesham Pool.



**Figure 1: Location of Wallasea Island**

- 2.2.3 On the north side of the island the Wallasea Wetland Reserve has been created by constructing a new sea defence and breaching the former seawall. The island is surrounded by a earth-bank sea wall which stands to a maximum height of approximately 104.6 to 104.8m Above Tunnel Datum (ATD) equivalent to 4.6 to 4.8m Ordnance Datum (OD). The interior of the island comprises flat agricultural land that lies at approximately 98 to 100m ATD (-2 to 0m OD). Beyond the seawall the eastern and southern sides of the island are fringed by saltmarsh.
- 2.2.4 The Crossrail works described in this SS-WSI are confined to the area known as Cell 1 situated on the eastern side of the island (Figure 2).

## **2.3 Stakeholder Consultation**

- 2.3.1 Initial consultation was undertaken with the Essex County Council Historic Environment Management Team (ECC HEM) regarding the works at Wallasea Island by email and phone on 5 October 2011 and 25 March 2012. The ECC HEM agreed with

recommendation for general watching brief and recording of any exposed sections of the sea wall which might indicate remains of earlier, particularly medieval, sea wall construction.

- 2.3.2 In June 2014 the RSPB also consulted with ECC Place Services (formerly the HEM) this consultation confirmed that the only element of Crossrail's works within Cell 1 that required archaeological monitoring were the sea wall breaches. Consultation undertaken by Crossrail with ECC Place Services has been ongoing since 2012 as changes to the scheme design have become apparent. Most recently on the 7 and 14 January 2015 where the specific methodology for archaeological recording during the sea wall breaches set out in this WSI was confirmed by ECC Place Services as being acceptable.

## **2.4 Summary of Previous Studies**

- 2.4.1 The Crossrail Generic WSI (Crossrail 2008a, Document No. CR-XRL-T1-GST-CR001-00003) outlines how the arrangements and controls for managing archaeology will be met in designing and constructing Crossrail. It also provides a common framework for archaeology which will ensure that the works conform to a common project standard. The Generic WSI is supported by additional documents outlining procedures for non-listed historic buildings (Crossrail, 2008b, Document No. CRL1-XRL-T1-GPD-CR001-00001) and the Archaeology Specification for Evaluation and Mitigation (including Watching Brief), (Crossrail 2008c, Document No. CRL1-XRL-T1-RSP-CRG03-50001).
- 2.4.2 As part of the Wallasea Wild Coast Project Dr Richard Macphail of University College London (UCL) carried out analysis of four trial pits to the northeast of the Cell 1 site, to provide data which would assist in understanding prehistoric and earlier sites which have been affected by the processes of marine inundation. His research identified the taphonomic effects on archaeological sites and provides a good control site for assessing prehistoric archaeological sites affected by similar marine inundation processes (Macphail et al 2010:51).
- 2.4.3 The research illustrated the nature of the buried soil environment along the eastern edge. The depths of the trial pits indicated modern (post-med) soil environments affected by marine inundation in grassland and arable lands. However the evidence from the trial pits did not provide conclusive evidence for the survival of earlier buried soil horizons (Macphail et al 2010:54).
- 2.4.4 The general archaeological potential of Wallasea Island is presented in the Wallasea Wild Coast Project Environmental Statement (ES) and supporting baseline appendix (ABP MER 2008). The baseline data and assessment presented in the MER ES has informed the archaeological assessment and evaluation of the likelihood of archaeological remains being present in land affected by Crossrail's operations at Wallasea Island and the extent and significance of the resource. The impacts arising from Crossrail's works on the baseline resource reported in the MER ES have also been assessed and an appropriate mitigation strategy for the archaeological resource determined.

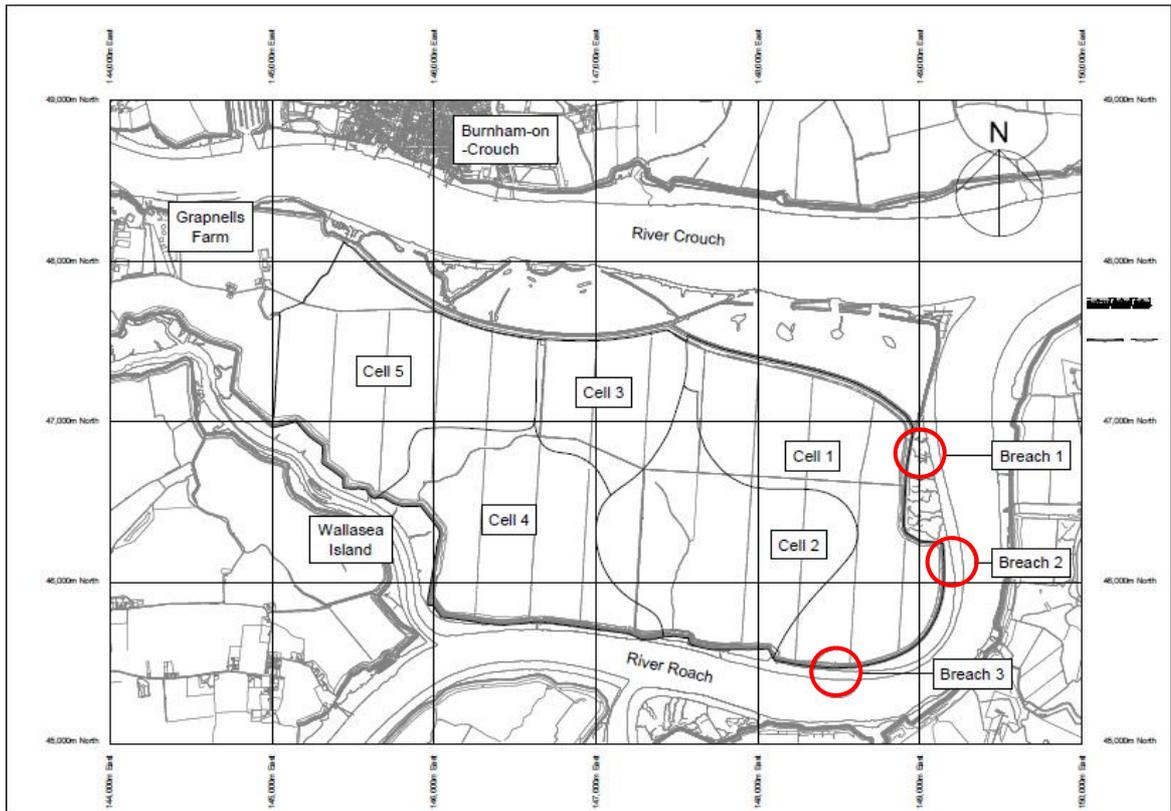


Figure 2: Location of Cell 1 and the breach locations

## 2.5 Previous Crossrail Archaeological Investigation

2.5.1 An archaeological investigation was undertaken by Crossrail in July 2013 during the excavation of ponds and surface features and distribution of spoil to create the RSPB wetland area within Cell 1. The archaeological works recorded a single feature comprising the remains of an adult cow buried in a shallow pit cut into the silty clay alluvial layers which cover the majority of the island. The lack of associated artefacts and the location of the remains just below the existing topsoil suggested that this was a modern animal burial. The results of the investigation are reported in the Crossrail fieldwork report (Crossrail 2014; Document No. C254-OXF-T1-RGN-CRG03-50175 Rev. 2.0).

## 2.6 Geology and Ground Investigation

2.6.1 The records of the British Geological Survey (BGS) indicate that the island is underlain by alluvial deposits comprising undifferentiated or clay, marine or estuarine alluvium, with river terrace deposits located at the western end of the island near Grapnells Farm (BGS 1976, 1:50,000 Series Geological Map, Solid and Drift, Sheet 258/259 Southend and Foulness).

- 2.6.2 Geotechnical investigations undertaken for the wider RSPB/MER Wallasea Island Wild Coast project have been reported in the 2008 ES. The results are summarised below (MER 2008:226):
- Made Ground (the embankments);
  - Soft marine clays;
  - Marine alluvial silts (generally under the embankments);
  - Alluvial sand (north side of the island only; and
  - Desiccated marine alluvial clays.
- 2.6.3 The ES notes that prior to and during the Neolithic period (4000-2000BC) this area would have comprised tidal silt flats and ridges of gravel and shell, with no evidence of prehistoric activity recorded during previous surveys and research on the island. The island developed into a marshland island by the Later Bronze Age (1000-700BC) (2008:226) as the inter-tidal flats and ridges slowly built up due to the fluvial action of silt deposition over a period of time.
- 2.6.4 Subsequent flooding events in the 20th century followed by remediation and levelling works have significantly altered the character of the island.

## 2.7 Archaeological and Historical Background of the Site

- 2.7.1 The archaeological and historical development of Wallasea Island has been presented in the MER ES (MER 2008). The relevant archaeological and historical evidence is summarised below.

### ***Prehistoric (700,000 BP to AD 43) and Roman (AD 43 to 410)***

- 2.7.2 Despite the potential for the survival of prehistoric land surfaces no known archaeological assets predating the Iron Age are recorded by the Essex Historic Environment Record (EHER).
- 2.7.3 The importance of the Essex coast for Late Iron Age and Roman (100BC-410AD) salt production is well known and the MER ES records the location of three characteristic 'red hills', or salt production sites on Wallasea. One of these red hill sites (EHER No. 11308) was located within Cell 1 (see Figure 3 below). A site walkover survey and review of historic aerial photographs and Lidar data for the MER ES revealed no evidence for the red hill.

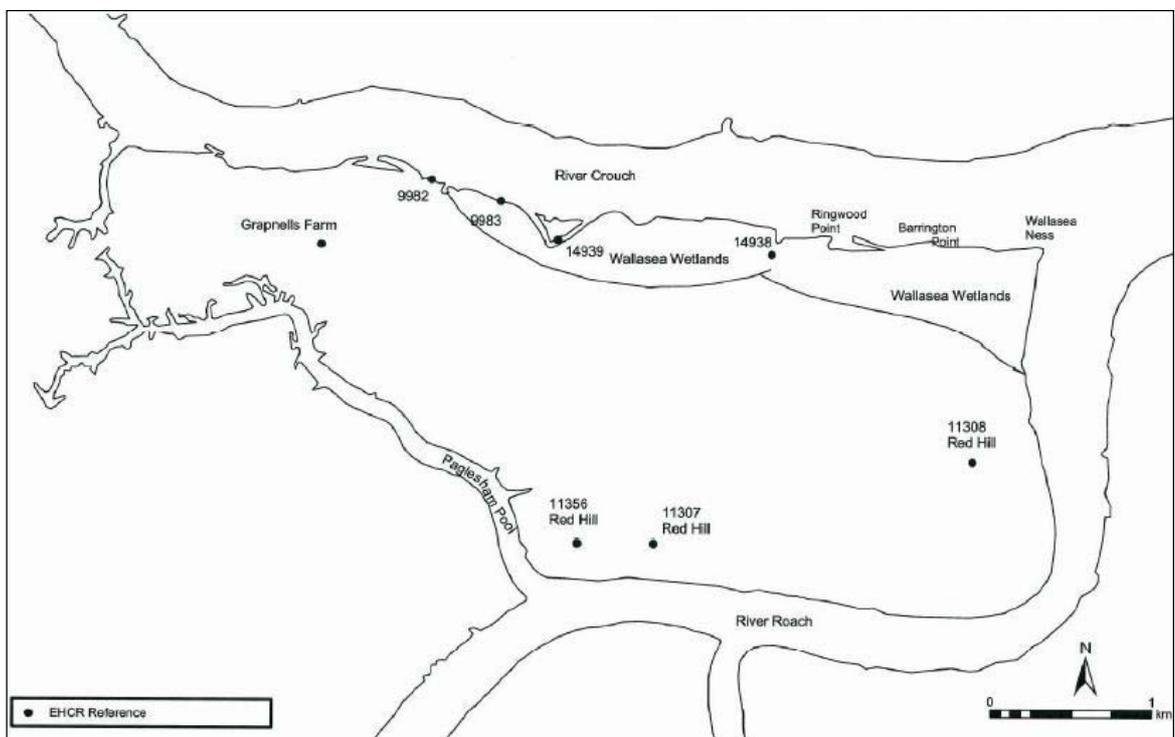
### ***Anglo-Saxon (AD 410 to 1066) and Medieval (1066 to 1540)***

- 2.7.4 By the late Saxon period the low lying marshes across Wallasea has become valuable as pasture for grazing livestock. The marshland pasture was divided between numerous parishes, as recorded in the Domesday Survey of AD 1086.
- 2.7.5 By the medieval period the valuable agricultural land required protection from flooding. Documentary evidence suggests the island was embanked in the 13th or 14th centuries. The interior of the island would have been sub-divided into a number of smaller areas of marsh. The routes of these embankments are visible on historic mapping; however, no surface evidence was visible during the site walkover survey conducted on 2008 and it is

likely that the former embankments were removed by modern levelling of the islands interior (EMR 2008:227).

2.7.6 Archaeological investigations during the 1970s on the island of Foulness, to the east of Wallasea, revealed the remains of medieval seawalls surviving beneath the existing sea walls. These earlier sea walls comprised timber and ragstone revetments and earthen banks.

2.7.7 The post-Roman settlement on the island is noted to have been initially transitory, perhaps seasonal occupation by fishermen and shepherds. No occupation sites are known prior to the early post-medieval period, although documentary sources identify permanent settlement on the island by the Tudor period (AD 1487-1603).



**Figure 3: Indicative location of EHER Red hills (© MER 2008)**

***Post-medieval (1540 to 1901)***

2.7.8 Chapman and Andre's map of 1777 records the location of 10 farmsteads across the island, along with the major creeks and seawalls. Only Devil's House farm (later Tile Barn Farm) was located within Cell 1. The 1777 map also indicates that the extent southern part of Cell 1, known as Tile Barn Marsh was smaller than it is today with what appears to be a sea wall or bank and ditch located further inland. The area immediately behind the modern sea wall appears to be tidal saltings at this time (Figure 4).

2.7.9 Modern aerial photos of the same area (see Figure 5) clearly show a buried feature visible on the same alignment corresponding to the bank and/or ditch shown on Chapman and Andre's map. This suggests that the land immediately behind the current southern seawall was reclaimed from saltings shown on Chapman and Andre's map of

1777. This is supported by documentary evidence cited in the MER ES which records that Tile Barn Marsh was 'inned' or embanked in 1790.

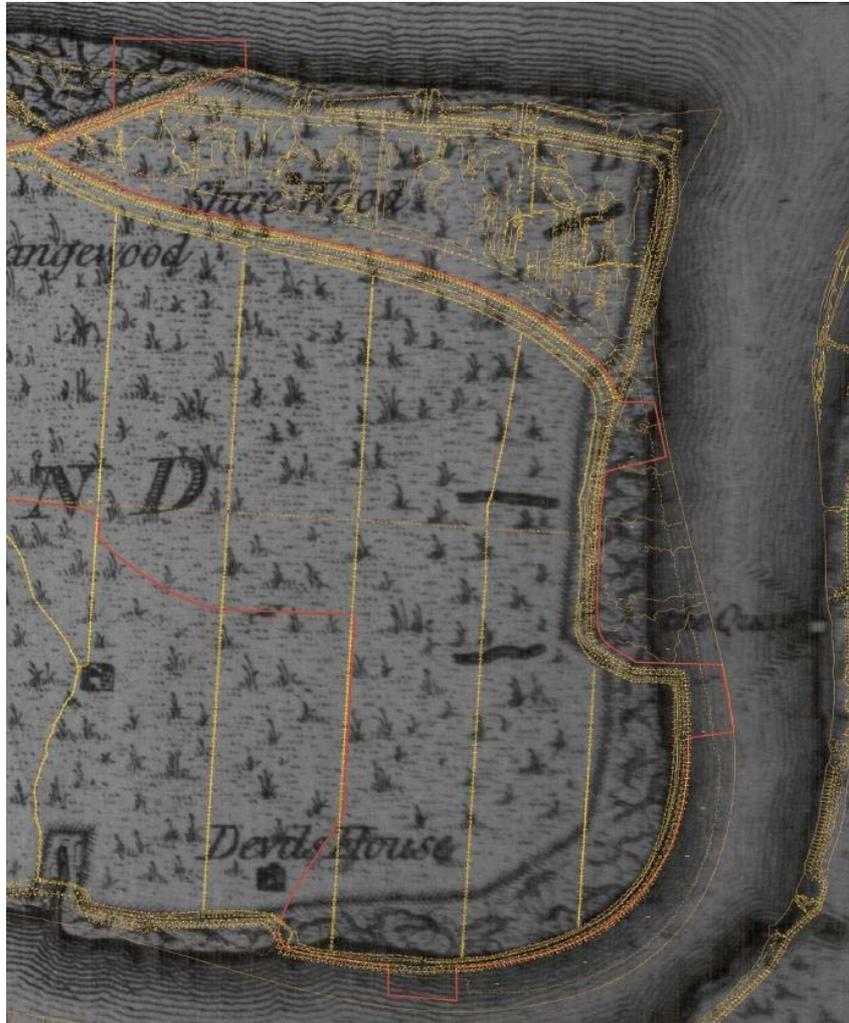


Figure 4: Extract from Chapman and Andre's 1777 map with overlay of the modern topography



**Figure 5: Modern aerial photograph of Tile Barn Marsh and the features shown on Chapman and Andre's 1777 map**

2.7.10 Ordnance survey mapping from the late 19th century records that the number of farmsteads on the island increased to 13 by 1875 suggesting an intensification of agricultural activity.

***Modern (1901 to Present)***

2.7.11 Agricultural decline and catastrophic flooding in the 20th century led to the gradual abandonment and demolition of the majority of settlements, and now there are no extant farms to the east of the existing Grapnells Farm. The majority of these were destroyed and any evidence of them removed post the 1953 flood and subsequent mitigation works.

2.7.12 On the edges of the islands there would have been a number of post-medieval loadings such as quays and jetties which would have served the farms and as ferry points linking to the mainland and neighbouring islands. No remains were visible during the earlier 2008 walkover. There are no traces of the once numerous farmsteads which were situated on the island. Today only Grapnells farmstead survives.

## 2.8 Previous Ground Disturbance

- 2.8.1 Wallasea Island has flooded a number of times in the recorded past, including 1551, 1736, 1897, 1928, 1938, and during the Great Tide of 1953. The 'Great Tide' of 1953 had a devastating effect on the island. Having over-topped the walls the island was flooded to a depth of 5-6ft, with subsequent tides breaching the walls on the north of the island. In order to drain the island a sand-bank counterwall was constructed.
- 2.8.2 On the 13 February 1953 mechanical excavators were landed at an improvised hard standing at Tile
- 2.8.3 Barns, on the south of the island (Greive 1959 in MER 2008:228). There are some visible dumps of stones in the intertidal area by Tide Barns which could be the remains of this work. Sections of the medieval and post-medieval seawalls were abandoned and new walls built inland. In aftermath the island was essentially 'barren' for 6 years and the land and soil on the island had to be processed by introducing 1000s of tonnes of gypsum to restructure the soil and allow it to recover from the saline intrusion.
- 2.8.4 In 1959 extensive re-drainage work took place, old boundaries infilled and new ones cut. The island to the east of Grapnells was levelled by a team of bulldozers over a period of six years and deep drainage was put in place.

## 3 Construction Impacts and Mitigation

- 3.1.1 The creation of the Cell 1 tidal lagoon will need to be created by connection the new landform with the local river system. This will be achieved by breaching the existing sea wall embankment adjacent to the River Roach at three locations (see Drawing No. C176-FAB-C-DWG-CRT00\_ES001-50017 at Annex 3).
- 3.1.2 The final breaching of the seawall must be undertaken during a Neap Tide to ensure that the excavation of the final sections of embankment can be safely completed within a single six hour period between the ebb tide and low water.
- 3.1.3 The pre-breach and breaching works will be undertaken in five phases (Phases 1 to 5), which are described in the C807 Principal Contractor's Method Statement (Document No. C807-BNV-W-GMS-CRT00\_ES001-50108) and summarised below.

### 3.2 Pre-Breach Works

- 3.2.1 Prior to the sea wall breaching works advanced works will be required. The pre-breach works are programmed to take advantage of the most optimum tide range and prevailing weather conditions at each breach location.

#### *Phase 1*

- 3.2.2 The first stage of pre-breach works will include the establishment of the working areas and access :
- temporary fencing and signage works;
  - excavation of a channel profile through the existing tidal salting's up to 8m from the toe of the seaward side of seawall;

- construction of a temporary access ramp onto the sea wall using material excavated from the breach deposition areas; and
- construction of a working platform for the 40 tonne 22m long reach excavator at the seaward toe of each side of the wall.

### ***Phase 2***

- 3.2.3 The second phase comprises the excavation of the tidal saltings between the existing sea wall and the River Roach to create a seaward channel. These works will be undertaken by a team of amphibious long reach excavators to first create a 10m wide central deep channel.
- 3.2.4 Excavated material will be moved to within reach of the 22 m long reach excavator by “hay making” the spoil in a landwards direction. The long reach excavator will then load the excavated material onto dump trucks.

### ***Phase 3***

- 3.2.5 During Phase 3 the upper shallow seaward channel section will be excavated to either side of the deeper channel using the same excavated method set out for Phase 2. The total width of the upper shallow channel will be 100m at each breach location.
- 3.2.6 During Phases 1-3 the existing sea wall will not be reduced in height to ensure that flood protection for the island is maintained and uncompromised. Once the saltings excavations are complete, the final breaching of the sea wall section will commence.

## **3.3 Sea Wall Breaching**

- 3.3.1 Following completion of the pre-breach works, the excavation of the existing sea wall to create each breach will be undertaken in two phases (Phases 4 and 5).

### ***Phase 4***

- 3.3.2 Prior to breach day and during the days preceding the breaching, the height of the existing sea wall will be reduced by mechanical excavator in pre-determined layers. Excavation will be timed to coincide with the most favourable tide levels and prevailing weather conditions. The sequence of excavation is set out in Appendix E of the C807 Construction Method Statement (Document No. C807-BNV-W-GMS-CRT00\_ES001-50108).
- 3.3.3 The extent of the sea wall lowering will be determined by the tide levels +500mm to avoid overtopping of the sea wall. Excavation of the sea wall will be undertaken at all three breach locations in parallel.

### ***Phase 5***

- 3.3.4 The final breaching will be undertaken on a single day (currently planned for the 11th July 2015) and in a controlled sequence with all three sea wall breaches will be carried

out concurrently as one operation to ensure that breaching is completed at the same time.

- 3.3.5 Two excavators will be employed at each breach site working away from the centre main channel area. Some casting and double handling of spoil may be required to ensure completion of the each breach. The material excavated from the sea wall will be loaded into articulated dump trucks by a tracked excavator.
- 3.3.6 When the sea wall has been excavated to 100.90m ATD (invert of the upper channel), the excavators will be repositioned so that both work from the same side of the channel only; Breach 1 will be from the North Side, Breach 2 from the South Side and Breach 3 from the West Side, so the plant can safely exit Cell 1. Excavation of each breach will then be completed to a depth of 98.60m ATD (BNVO 2015; Document No. C807-BNV-W-GMS-CRT00\_ES001-50108).
- 3.3.7 During the sea wall breaching access to the working areas will be strictly controlled to ensure the safety of all personnel and will be limited to plant and dumper operators.

### **3.4 Post-breach**

- 3.4.1 Following completion of the final breach the exposed ends of the remaining sea wall will be graded by mechanical excavator to form a level lower plateau at the toe of the sea wall and battered face. These works will minimise erosion of the remaining sections of sea wall.
- 3.4.2 Once this has been completed timber and post fencing and permanent signage will be erected to protect visitors to the island from the edges of each breach.

### **3.5 Outline Mitigation Design**

- 3.5.1 The assessment of the likely archaeological resource with Crossrail's Wallasea Island site has identified that the sea walls enclosing Cell 1 have the potential for the survival of archaeological remains associated with medieval or earlier sea walls. The remains of any earlier structures may survive within or beneath the existing flood defences in the form of timber revetments or posts, stone retaining walls or earthen banks.
- 3.5.2 The following archaeological mitigation has been developed in consultation with officers from ECC Place Services and will be implemented during the breaching works.

#### ***Pre-Breaching***

- 3.5.3 No known archaeological assets or relict creeks have been identified within the tidal saltings at each breach location. Consequently no archaeological monitoring will be undertaken during these works.
- 3.5.4 There remains a possibility for unexpected archaeological discoveries in the form of timber structures or the remains of wrecks or hulks buried in the estuarine silts. In the event that such remains are encountered during the excavation of the seaward channels the Principal Contractor will notify the Crossrail Project Archaeologist and follow the procedures for Unexpected Discoveries set out in this SS-WSI and the C807 Wallasea Archaeological Management Plan (Document Number C807-BNV-W-STP-CRT00\_ES001-50017).

### ***Sea Wall Breaching***

- 3.5.5 Due to the restricted nature of each work site once machine excavation has commenced there is a need to minimise the personnel required at each breach location. The site conditions and swing arm radius of each excavator will be such that there will be no position of safety or opportunity for an archaeologist to safely enter or reasonably monitor the lowering or breaching of the sea wall.

### ***Post-Breaching***

- 3.5.6 At low tide on the days immediately following the completion of the sea wall breaching the freshly excavated and battered face of the current sea wall at Breaches 1 and 3 will be accessible for archaeological inspection and recording.
- 3.5.7 Archaeological inspection of the exposed sea wall under a general watching brief methodology will enable a visible section through the structure of the sea wall to be investigated. Following inspection of the sea walls any medieval or earlier structural remains present could then be identified and recorded.
- 3.5.8 The archaeological works will be subject to a task specific method statement and safe method of work prepared in consultation with and approved by the Principal Contractor and Crossrail.
- 3.5.9 The archaeological work shall be carried out for Crossrail by their archaeological contractor C254 Oxford archaeology.

## **4 Aims and Objectives**

- 4.1.1 The overall objective of the archaeological general watching brief is to mitigate the impact of the breaching works on the archaeological resource through a programme of archaeological investigation, recording, analysis and dissemination in accordance with the Crossrail Generic WSI (document number CR-PN-LWS-EN-SY-00001) and the standards listed therein.
- 4.1.2 Archaeological investigations at each breach location have the potential to recover evidence of post-medieval, medieval or earlier sea walls constructed to protect the former agricultural land and pastures of Wallasea from flooding.

### **4.2 Site Specific Aims**

- 4.2.1 The specific aims of the archaeological targeted watching brief are:
- to preserve by record any surviving evidence of post-medieval, medieval or earlier sea wall embankments within or beneath the existing sea wall;
  - to record the development of the sea wall embankments through assessment of the soil stratigraphy and the survival of any structural remains;
  - to identify the location, extent and depth of post-medieval and modern truncation of archaeological and natural deposits, particularly in relation to the construction of the existing sea wall;

- to identify and record any evidence for buried soil horizons or former land surfaces that may be sealed beneath the existing sea wall;
- to identify and record any evidence for variation in the method or material used to construct the sea wall at breach locations; and
- to identify and record any evidence to support the historic map and documentary sources that suggest that the southern section of sea wall at Breach 3 may be post-medieval in date and relating to the 'inning' of Tile Barn Marsh in 1790.

### 4.3 Relevant Research Aims

- 4.3.1 The 2010 update to the Greater Thames Estuary Research Framework identifies sea walls as having *“great potential to integrate historical and archaeological studies”*. Further sea walls are *“...indicative of coastal changes, landownership and management, and changes in agricultural policy...have the potential to contribute to understanding the topographical evolution of the Greater Thames Estuary through to the modern day...”*. (ECC FAU 2010).
- 4.3.2 Framework Object 3B identifies three specific research objectives for the study of sea walls in the Greater Thames Estuary:
- Developing an overview of the evolution of sea defences in relation to sea-level and climatic change.
  - Developing an understanding of the construction methods of seawalls and their water control mechanisms.
  - Developing an understanding of the historical context of sea defences in terms of secular and ecclesiastical land ownership and exploitation.
- 4.3.3 A specific area of research that the general watching brief could contribute to would be:
- Establishing a chronological framework for the development of sea defences.

## 5 Scope of the Investigation

### 5.1 Specific Requirements for the C807 Principal Contractor

#### ***General Watching Brief***

- 5.1.1 A site inspection by the C254 Archaeological Contractor accompanied by the Crossrail Archaeologist and Site Manager will be required immediately following completion of the Cell 1 sea wall breaching at Wallasea Island. Where medieval or earlier remains are identified or the internal structure of the seawall requires recording, archaeological investigation and recording under a General Watching Brief will take place.
- 5.1.2 Archaeological investigation by General Watching Brief is defined in the Generic WSI (CR-PN-LWS-EN-SY-00001) which states that:  
*A general watching brief shall comprise observation and recording of the Principal Contractor's works without constraint on their working methods.*
- 5.1.3 The general watching brief will take place immediately after the sea wall breaching. Prior to the start of works the C807 Principal Contractor will advise the C254 archaeological contractor when machine excavation will be taking place and arrange attendance by an archaeologist.
- 5.1.4 At each Breach location the C807 Principal Contractor will excavate a level plateau and batter back the end of the sea wall exposing a cross section through its internal structure. An excavator fitted with a toothless, smooth bladed grading bucket will provide the clean surface required for archaeological inspection.
- 5.1.5 Any archaeological horizons encountered will be hand cleaned as necessary to achieve clear definition including any archaeological features which will then be rapidly investigated, sampled and recorded by the C254 archaeologists. Sections through the stratigraphic sequence will also be cleaned, recorded and sampled as appropriate.
- 5.1.6 Excavation in this manner will allow the full sequence of deposits to be examined and recorded.

#### ***Archaeological General Watching Brief Procedure***

- 5.1.7 Following the completion of the sea wall breaching works the following procedure is to be incorporated into the C807 Principal Contractor's method of working:
- The Principal Contractor should confirm that there are no live services and identify any site specific hazards within the breach areas and brief the C254 archaeologist;
  - Provide as clean a excavated surface at the exposed face at the end of the sea wall at Breach 1 and Breach 3 and allow the C254 archaeologist adequate time to view and if necessary clean, record and recover samples from the cross-section through the sea wall and any medieval or earlier remains present;
  - Allow adequate time for any surviving archaeological remains to be investigated and recorded. The duration of any archaeological investigation and recording required may vary dependant on the density and complexity of archaeological remains

present. This will be instructed by the Project Manager following discussion with the Crossrail Project Archaeologist, and C254 Archaeologist;

- Allow suitable secure access, shoring and edge protection where required from ground level and alongside the top of the sea wall and channel areas for the archaeologists to work;
- Use of excavators or other plant within the excavation area shall only be undertaken with the agreement of the Project Manager and under the supervision of C254 Archaeologist;
- Allow for up to 4 No. archaeologists to be on site during post-breach works; and
- Provide further technical advice to C254 as maybe required to safely complete the work.

5.1.8 If the internal structure of the sea wall is not visible or significant archaeological remains are revealed the C807 Principal Contractor may, following consultation with the Project Archaeologist and Crossrail Project Field Engineer, be required to provide plant fitted with a toothless, smooth bladed grading bucket and an operator to facilitate limited machine cleaning of the exposed face of the sea wall. If plant assisted cleaning is required the machine will excavate in spits, under supervision of C254 Archaeologist to reveal the deposit sequence or archaeological remains.

## 5.2 Site Accommodation and Facilities

5.2.1 The C807 Principal Contractor shall provide the following site accommodation facilities for the use of the C254 archaeological operatives (No. to be determined in C254 Method Statement), inclusive of any hard standing and services required:

- Welfare and mess facilities;
- Male and Female toilets, with drying and washing facilities;
- First Aid;
- Storage for small plant and tools; and
- Temporary office space including 1 No. desk space for the use of the C254 lead archaeologist complete with furniture, telephone and internet access.

## 5.3 Specific Requirements for the C254 Archaeological Contractor

5.3.1 Prior to the start of the general watching brief the C254 Archaeological Contractor will ensure that they have consulted with the C807 Principal Contractor regarding site specific constraints, reviewed up-to-date tide tables and prepared a safe method for working near/adjacent to water.

5.3.2 During the general watching brief particular attention will be paid to the internal structure of the sea wall for the presence of any timber sub-structure, stone core or facing material

posts and former turf lines or buried soil horizons which may indicate different phases of sea wall construction.

- 5.3.3 To deliver the archaeological general watching brief the C254 Archaeological Contractor shall:
- Prior to the start of work provide an Archaeological Method Statement inclusive of risk assessment and safe method of working;
  - Ensure that all staff undertaking the watching brief have attended a C807 site induction;
  - Provide a suitably qualified and competent staff who have valid CSCS cards;
  - Provide a suitably qualified archaeologist, experienced in archaeological investigation, recording and the nature of archaeological deposits which are expected on this site;
  - Provide (if appropriate) a suitably qualified geoarchaeologist, experienced in archaeological investigation, recording and the nature of archaeological deposits which are expected on this site; and
  - Ensure that during the archaeological general watching brief the extent of the any surviving archaeological deposits are mapped and that any surviving archaeological remains are hand cleaned, defined and sample excavated, sufficient to determine type, plan form and relationships and that these are recorded.

## 6 Programme for the Investigation

- 6.1.1 The pre-breach works (Phases 1-3) will be undertaken sequentially from early March 2015 starting at Breach 3 before moving on to Breach 2 then Breach 1.
- 6.1.2 The Phase 4 reduction of sea wall level (all locations) is currently proposed to be undertaken from the 05 to 11 July 2015.
- 6.1.3 Breach Day itself (Phase 5 works) will take place on the 11 July 2015.
- Post-breach works are anticipated to take place on Monday 13 July 2015 onwards for several days. The general watching brief will be undertaken during the week commencing 13 July and will be dependent on the timing of low tide.
- 6.1.4 The Wallasea Island site working hours are currently set as 07:00-19:00hrs Monday to Friday and 07:00-13:00hrs Saturdays.

## 6.2 Post-Breach Tides

6.2.1 A Tide table for the Wallasea Island area is provided below.

July 2015 - Tides for Bumham-on-Crouch								
DAY	AM Tide				PM Tide			
	HW	M	LW	M	HW	M	LW	M
1 Wed	00:30	4.88	06:43	0.33	12:52	5.06	19:12	0.36
2 Thu	01:19	5.10	07:31	0.24	13:39	5.20	20:01	0.18
3 Fri	02:05	5.26	08:16	0.20	14:22	5.28	20:47	0.06
4 Sat	02:49	5.34	08:59	0.20	15:04	5.29	21:31	-0.01
5 Sun	03:33	5.35	09:41	0.24	15:45	5.26	22:15	-0.01
6 Mon	04:18	5.30	10:24	0.29	16:28	5.19	23:01	0.03
7 Tue	05:04	5.19	11:08	0.38	17:13	5.08	23:48	0.12
8 Wed	05:53	5.03	11:57	0.48	18:02	4.92		
9 Thu	06:46	4.84	00:41	0.23	18:56	4.75	12:51	0.58
10 Fri	07:45	4.67	01:39	0.35	20:00	4.59	13:53	0.67
11 Sat	08:51	4.59	02:46	0.43	21:12	4.55	15:06	0.67
12 Sun	09:59	4.63	03:59	0.41	22:24	4.66	16:23	0.54
13 Mon	11:02	4.79	05:05	0.30	23:28	4.87	17:30	0.30
14 Tue	11:59	4.98	06:02	0.17			18:28	0.06
15 Wed	00:24	5.07	06:53	0.10	12:51	5.11	19:20	-0.11
16 Thu	01:15	5.19	07:39	0.10	13:39	5.16	20:08	-0.18
17 Fri	02:02	5.18	08:21	0.18	14:21	5.11	20:51	-0.12
18 Sat	02:44	5.07	08:57	0.32	14:58	4.98	21:30	0.02
19 Sun	03:21	4.89	09:27	0.48	15:28	4.84	22:02	0.19
20 Mon	03:51	4.73	09:51	0.59	15:53	4.76	22:30	0.33
21 Tue	04:20	4.64	10:18	0.65	16:23	4.74	23:00	0.44
22 Wed	04:54	4.60	10:54	0.70	17:00	4.70	23:36	0.52
23 Thu	05:33	4.56	11:34	0.77	17:43	4.62		
24 Fri	06:19	4.50	00:20	0.61	18:33	4.48	12:21	0.87
25 Sat	07:11	4.40	01:11	0.71	19:29	4.32	13:15	0.99
26 Sun	08:12	4.31	02:09	0.80	20:39	4.19	14:21	1.07
27 Mon	09:23	4.30	03:16	0.83	22:00	4.24	15:39	1.06
28 Tue	10:35	4.45	04:27	0.75	23:10	4.49	16:57	0.88
29 Wed	11:38	4.71	05:33	0.59			18:03	0.58
30 Thu	00:09	4.83	06:30	0.39	12:32	4.98	18:59	0.25
31 Fri	01:02	5.15	07:20	0.21	13:21	5.21	19:49	-0.02

**2015 Tides**

- 2015 January
- 2015 February
- 2015 March
- 2015 April
- 2015 May
- 2015 June
- **2015 July**
- 2015 August
- 2015 September
- 2015 October
- 2015 November
- 2015 December

**2014 Tides**

**Times are adjusted for BST**

Datum of Predictions  
 Chart Datum = 2.35m below  
 Ordnance Datum Newlyn.

Highest Astronomical Tide (HAT)=5.76m  
 Lowest Astronomical Tide (LAT)=-0.71m  
 Mean HW Springs (MHWS)=4.90m  
 Mean HW Neaps (MHWN)=3.85m  
 Mean LW Springs (MLWS)=0.10m  
 Mean LW Neaps (MLWN)=1.15m  
 Average Flood Time=6hrs 9m  
 Average Ebb Time=6hrs 16m

## **7 Specification for archaeological evaluation and mitigation**

### **7.1 Generic Standards**

7.1.1 The archaeological evaluation and mitigation works and scope of any archaeological scientific methods shall be designed and undertaken in accordance with the Generic WSI and relevant best practise guidance (and any subsequent revisions) i.e.:

- Crossrail standards and specifications;
- Chartered Institute for Archaeologists – Standard and Guidance for archaeological field evaluation, 2014a;
- Chartered Institute for Archaeologists – Standard and Guidance for archaeological excavation, 2014b;
- Chartered Institute for Archaeologists – Standard and Guidance for an archaeological watching brief, 2014c;
- Museum of London collections and archive policies and guidance;
- English Heritage – Geoarchaeology, 2007;
- English Heritage - Archaeological Science at PPG16 interventions: Best Practice Guidance for Curators and Commissioning Archaeologists, 2003;
- English Heritage GLAAS Standards for Archaeological Work 2014); and
- Museum of London Archaeology Service site recording manual (MOLAS 1994).

### **7.2 Potentially nationally important remains**

7.2.1 Where unexpected, potentially nationally important archaeological remains (as defined in the Crossrail Environmental Minimum Requirements and Generic WSI) are identified during the works, the Archaeology Contractor shall undertake works in accordance with the Environmental Requirements (archaeology) section of the relevant package Works Information and shall adhere to procedures as set out in the SS-WSI.

7.2.2 The Archaeology Contractor shall submit details of their procedure for excavating and recording potentially nationally important remains in the Archaeology Contractor's Method Statement.

7.2.3 In the event that archaeological remains of potentially national importance are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of archaeological remains of potentially national importance will be confirmed in writing within 24hours of discovery.

- 7.2.4 The Project Archaeologist will be responsible for informing the relevant statutory consultees (EH GLAAS) and co-ordinate any meetings required between Crossrail Central, the C807 Principal Contractor, the C254 Archaeology Contractor and the relevant statutory consultees.
- 7.2.5 The C807 Principal Contractor will be responsible for supplying any material required to protect archaeological remains of potentially national importance from possible damage by ongoing construction activities in the vicinity. This may include the provision of barrier fencing, terram and sand.
- 7.2.6 As a result of the discovery of unexpected, potentially nationally important archaeological remains, the SS-WSI will be updated by the Project Archaeologist to incorporate any additional specific primary fieldwork event aims.

### **7.3 Human Remains**

- 7.3.1 Certain aspects of the normal legal procedure for the removal of human remains (and associated monuments) from burial grounds has been modified by Schedule 15 to the Crossrail Act 2008. However for other aspects, normal legislation applies.
- 7.3.2 Where human remains are identified, all subsequent works must be undertaken in accordance with relevant legislative and environmental health requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.
- 7.3.3 In the event that human remains are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of human remains will be confirmed in writing within 24 hours of discovery during which time C254 will apply for the relevant Ministry of Justice (Coroner's Division) licence.
- 7.3.4 The Project Archaeologist will be responsible for informing the relevant statutory consultees Archaeological Officers from Essex County Council Place Services and co-ordinate any meetings required between Crossrail, the Principal Contractor, the C254 Archaeology Contractor and the relevant statutory consultees.
- 7.3.5 The Archaeology Contractor shall confirm how the requirements set out in the SS-WSI will be implemented as part of their procedure for excavating and recording human remains in the Archaeology Contractor's Method Statement. This should incorporate best practice guidance e.g. Council for the Care of Churches (1999) and English Heritage (2002 and 2002a).
- 7.3.6 At sites known in advance to have a high risk of encountering human remains, provision shall be made by the Archaeology Contractor for site inspection by a recognised specialist.
- 7.3.7 Should human remains be discovered, the Archaeology Contractor shall notify the Project Archaeologist immediately so that these procedures can be implemented. This notification may be initially made personally or by telephone but shall be confirmed in writing within 24 hours of discovery.
- 7.3.8 The Principal Contractor will be required to cease all works at that location until further instruction is provided by the Project Archaeologist. The Archaeology Contractor shall

undertake an initial in situ observation and assessment of the remains and shall advise the Project Archaeologist of the course of action required.

- 7.3.9 Lifting of human skeletal remains shall be kept to the minimum which is compatible with an adequate evaluation or excavation. Notwithstanding this, the Archaeological Contractor shall ensure that all burials are planned/photographed in-situ and that appropriate samples have been recovered prior to any lifting.
- 7.3.10 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 Archaeology Contractor shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor. As a minimum, this will require a 24 hour comprehensive security regime until sensitive remains have been recorded and lifted.
- 7.3.11 As a result of the discovery of unexpected, potentially nationally important archaeological remains, the SS-WSI will be updated by the Project Archaeologist to incorporate any additional specific primary fieldwork event aims.

## **7.4 Treasure Act**

7.4.1 The Treasure Act 1996 defines 'Treasure' as:

- Any object at least 300 years old when found which is: not a coin, but has metallic content of which at least 10% is precious metal; or
- One of at least two coins with at least 10% precious metal content;
- One of at least 10 coins;
- Any object at least 200 years old designated as treasure by the Secretary of State;
- Any object which would have been 'Treasure Trove';
- Any object found with any of the above.
- The Treasure (Designation) Order 2002 extends the definition of treasure to include:
  - Finds of at least two base metal objects (other than coins) of prehistoric date; and
  - Any object (other than a coin) of prehistoric date with any precious metal content.

7.4.2 All finds falling within the definitions of treasure shall be reported immediately to the Project Archaeologist and all subsequent works must be undertaken in accordance with the relevant legislative requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

7.4.3 To protect the finds from theft, the Archaeology Contractor shall record the finds and remove them to a safe place. Where recording and removal is not feasible or appropriate on the day of discovery, the Archaeology Contractor shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor.

7.4.4 Subject to the Provisions of the Treasure Act 1996, all material that is defined as Treasure is vested in the franchisee or, if none, the Crown.

7.4.5 With respect to Treasure finds, a reward may be payable to the finder, the landowner and/or the occupier. The Crown usually offers finds to a museum.

## **7.5 Health and safety**

7.5.1 The Archaeology Contractor shall undertake the works in accordance with the Employer's Health and Safety requirements and the Principal Contractor's Health and Safety Plan. Where specific health and safety constraints or requirements for the Archaeology Contractor's method of work are required, these shall be set out in this section and detailed in the Archaeology Contractor's Method Statement (in the Health and Safety Plan).

7.5.2 No ground intervention or other survey shall be made without approval of the C254 Archaeology Contractor's Health and Safety Plan, Method Statement and Risk Assessment by the Principal Contractor (BNVO) and the CDM co-ordinator.

7.5.3 Hand excavation or other remote sensing method may be required prior to any mechanical excavation in the first instance to locate any known or suspected below ground hazards. The Archaeology Contractor's Method Statement and Risk Assessment shall take account of any design information (including the Designer's and Principal Contractor's Risk Assessment) pertaining to above ground hazards such as buildings and other structures or public rights of way and below ground hazards such as services, utilities and infrastructure and shall contain a site specific Risk Assessment for unknown below ground hazards such as contaminants including unexploded ordnance. All appropriate mitigation measures shall be in place prior to commencement of any ground intervention or other survey.

7.5.4 Any earthworks support design, shall conform to Health and Safety legislation and safety standards as well as incorporating current engineering best practice, where appropriate.

## **7.6 Location and ground elevation of interventions and survey grids**

7.6.1 The spatial extent of the investigation(s) shall be set out in accordance with the setting out co-ordinates supplied by the Project Archaeologist. All spatial setting out and recording shall be in accordance with The London Survey Grid Standard (formerly Crossrail Survey Grid). See Crossrail standard CR-STD-010.

7.6.2 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 a Total Station Theodolite or other suitable automated equipment referenced from approved Permanent Ground Marker (PGM) data supplied to the Archaeology Contractor by the Project Archaeologist. The positions of the trenches and survey points shall be verified by the Archaeology Contractor taking additional check measurements to additional known-location points of detail.

7.6.3 Surface heights shall be recorded and related to PGMs or approved Ordnance Survey Bench Marks (OSBM) .The full descriptions and locations of PGMs and OSBMs known to the Employer will be supplied to the Archaeology Contractor by the Project

Archaeologist. Levelling accuracy between OSBMs/PGMs and site TBMs shall be within  $10 \text{ mm} \sqrt{k}$ : where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or Crossrail PGMs. Where more than one TBM is required per site the Archaeology Contractor shall establish the TBMs as part of the same closed loop.

7.6.4 The Archaeology Contractor shall include details of their surveying methodology within their Method Statement (see Section 8), including the setting out of the grid and how they intend to provide the project grid co-ordinates to the Project Archaeologist with the Survey Report.

7.6.5 The Archaeology 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 Project Archaeologist within the Survey Report.

## 7.7 Specification for watching brief

### Scope of Watching Brief

7.7.1 Watching brief, as defined in the Generic WSI, is a programme of archaeological monitoring (i.e. observation, investigation and recording) which is carried out by a suitably qualified archaeologist during site investigations (e.g. geotechnical test pits, boreholes and utilities trial trenches) and construction works. The purpose of a watching brief 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). The watching brief shall result in the preparation of an ordered archive which will be incorporated into the post-excavation works and into publication of the project results.

7.7.2 The Archaeology Contractor shall undertake the watching brief for the sea wall breach locations which may potentially contain archaeological remains as set out in the SS-WSI.

7.7.3 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 be excluded from the scope of the watching brief, unless stated otherwise in the SS-WSI. Areas that have been subject to previous assessment and evaluation (e.g. geophysical survey, surface artefact collection, geotechnical survey, trial trenching etc.) shall be included within the watching brief, as appropriate.

7.7.4 Two classes of watching brief are set out in the Generic WSI:

- A General Watching Brief shall comprise observation and recording of the Principal Contractor's works without constraint on their working methods.
- A Targeted Watching Brief shall comprise observation and recording of the Principal Contractor's works with specific operations carried out under the supervision of the Archaeology Contractor. Under Targeted Watching Brief, the Archaeology Contractor may impose constraints on, or require changes to, the Principal Contractors' or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works.

7.7.5 The Principal Contractor shall make allowance in their activity programme for the completion of any General Watching Briefs as set out in the SS-WSIs.

**Specification for watching brief**

7.7.6 The requirement for the Archaeology Contractor to undertake a General Watching Brief immediately after the sea wall breaching has been set out in this SS-WSI.

7.7.7 The Works to be carried out by the Archaeology Contractor shall consist of two parts:

- a) Watching brief ('observation') following, and without interruption to, the progress of the Principal Contractor by a core team of archaeologists.
- b) Investigation of archaeology and remains of quaternary geological importance undertaken either:
  - by the core team, following the progress of the Principal Contractor; or
  - by additional archaeologists (the 'support team'), to be deployed to investigate unanticipated archaeological remains, where appropriate.

7.7.8 The Archaeology Contractor's core team shall consist of the Archaeology Contractor's key person (the field director) and other appropriately experienced archaeologists commensurate with the scale and nature of the Principal Contractor's works.

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

7.7.10 The Archaeology Contractor's support team shall consist of additional experienced archaeologist. The size of the support team shall be commensurate with the scale and programme of the Principal Contractor's works. The Archaeology Contractor shall be required to supply teams of 5 and 10 persons within 24 and 48 hours notice respectively.

7.7.11 The Archaeology Contractor's core and support teams shall be advised where necessary by specialists, as appropriate and as agreed with the Project Archaeologist.

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

- The Event Code and 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.

### **Investigation undertaken during watching brief**

- 7.7.13 An appropriate sample 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. The extent of sampling shall be determined by the Archaeology Contractor in liaison with the Project Archaeologist (and as discussed with the relevant local authority and English Heritage, and a quaternary specialist, if necessary) 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 Archaeology Contractor's Method Statement.
- 7.7.14 Heights for all deposits shall be related to approved Permanent Ground Markers (PGMs) or approved Ordnance Survey Bench Marks (OSBM), where reasonably accessible. Levelling accuracy between OSBMs/PGMs and site Temporary Bench Marks (TBMs) shall be within 10 mm ± k: where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or URL PGMs. Where more than one TBM is required per site, the Archaeology Contractor shall establish the TBMs as part of the same closed loop. The Archaeology Contractor shall prepare a record of their surveying methodology for inclusion in the archive.
- 7.7.15 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.

### **Recording standards**

- 7.7.16 The archaeological remains shall be recorded to best practice standards, recognising the special circumstances of a watching brief which demand flexibility in order to achieve archaeological objectives and requirements within the construction environment.
- 7.7.17 The recording is to include as a minimum:
- The written record of individual context descriptions on appropriate pro-forma.
  - The drawn record shall normally include, plans and section drawings of appropriate features, structures and individual contexts (1:50 1:20 or 1:10). Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located though co-ordinates, annotated with dimensions, and may be recorded digitally.
  - Other appropriate drawn and written records shall also be produced (for environmental sampling etc.).

- The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format (film or digital) SLR camera is acceptable for all site photography. The Archaeology Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph and transparency shall clearly show details of the above. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the event code and context/feature number. In addition, the Archaeology Contractor shall take appropriate record photographs to illustrate work in progress.

## **7.8 Specification for archaeological investigation**

- 7.8.1 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.
- 7.8.2 The general watching brief shall be assigned a unique ID number by the Project Archaeologist. The Archaeology Contractor shall not vary this number unless agreed by the Project Archaeologist in writing.
- 7.8.3 Temporary works and any required hand investigation to address below ground hazards shall be carried out by the Principal Contractor under supervision by the Archaeology Contractor in accordance with their approved Method Statement and Risk Assessment. All subsequent trial excavations shall be excavated by the Principal Contractor under supervision by the Archaeology Contractor using a mechanical excavator with toothless ditching bucket, except where the nature of the made ground or surface of the pits is such that an alternative bucket or means of breaking out prior to excavation is required (and the Project Archaeologist has agreed an alternative method).
- 7.8.4 All machine work shall be carried out by the Principal Contractor where necessary under supervision by the Archaeology Contractor. The Principal Contractor shall cease work when archaeological evidence is revealed and allow the Archaeology Contractor to undertake investigation, as appropriate. An excavator shall not be used to cut arbitrary trial trenches down to natural deposits without regard to the archaeological stratification.
- 7.8.5 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 of 0.20m-0.5m depth (dependant on specific site conditions), moving along the length of the trench or area. The Archaeology Contractor's supervising archaeologist shall use their professional judgement to determine the appropriate depth of each spit and will advise the Principal Contractor accordingly. Any variations to the

excavation methodology shall be at the discretion of the supervising archaeologist and recorded in writing for inclusion in the final report to the Project Archaeologist.

- 7.8.6 Each spit shall be examined carefully to assist the recovery of any archaeologically significant artefacts and thus to determine when to cease machining.
- 7.8.7 The archaeological level shall be cleaned in plan by the Principal Contractor using a wide blade, ditching bucket or similar, with no teeth. If the machine has to re-enter the trench care will need to be taken to ensure that it does not damage underlying remains.
- 7.8.8 The Archaeology Contractor shall undertake hand excavation and cleaning of any archaeologically significant horizons, to fulfil the aims of the work. Within alluvial sequences the Archaeology 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 Archaeology 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.
- 7.8.9 The Archaeology Contractor's excavation, sampling and recording policy shall be included in the Archaeology Contractor's Method Statement. This is to include, as a minimum:
- The recording of individual contexts on appropriate pro-formas;
  - Excavation plans at 1:50 scale; planning and section drawing of appropriate single contexts and features (usually at 1:20 scale for plans and 1:10 scale for inhumations and sections);
  - Photographs; and other appropriate drawn and written records; and
  - Permanent Ground Markers (PGM's), any temporary benchmarks and approved OS benchmarks shall be indicated on the relevant plans.
- 7.8.10 The Archaeology Contractor's survey and recording policy shall meet the following requirements:
- All levels shall be recorded to London Grid standards and reduced to OS datum;
  - All trial pit locations shall be electronically surveyed with reference to the London Grid and Crossrail PGM's upon the completion of fieldwork by the Archaeology Contractor;
  - The locations of trial pits shall be plotted on appropriate scale plans related to the London Grid and labelled with six figure eastings and northings; and
  - The electronic survey record shall be retained with the project archive.
- 7.8.11 In alluvial sequences, each trial excavation shall be excavated to the base of the alluvial sequence, and shall be appropriately shored and kept free of water by the Principal Contractor to allow 'person entry' to the excavations i.e. to allow the Archaeology Contractor to undertake investigation and recording to fulfil the aims of the work.
- 7.8.12 The Archaeology Contractor shall identify any temporary works and dewatering requirements associated with the archaeological investigation in the Archaeology Contractor's Method Statement and shall agree the detailed arrangements for such with the Principal Contractor. The Archaeology Contractor will be required to undertake works in accordance with the Principal Contractor's arrangements for matters such as off site-

spoil disposal or storage, on-site facilities and services. Relevant requirements shall be incorporated in the Archaeology Contractor's Method Statement.

7.8.13 Where areas of extensive archaeological stratification are encountered, trial trenches shall not be fully excavated. However, the horizontal and vertical extent of archaeological stratification shall be assessed by the Archaeology 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 Archaeology Contractor during the excavation of individual trenches and agreed with the Project Archaeologist.

7.8.14 A sufficient sample shall be excavated from cut features and other archaeological deposits to fulfil the aims of the work. Sampling of cut features shall include feature intersections to establish relative chronologies.

### **Recording systems**

7.8.15 The trial excavations shall be recorded by the Archaeological Contractor to the standards of current best practice. The recording systems adopted during the investigations must be fully compatible with those published by the Museum of London Archaeology Service (MoLAS 1994 3rd ED) and Museum of London (MoL 1998).

7.8.16 The recording is to include, as a minimum:

- At least one representative section at (1:10 or 1:20 scale) of each trial 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 or 1:20);
- Single context planning if appropriate; and
- Photographs and other appropriate drawn and written records.
- Other sections, including the half-sections of individual layers or features shall be drawn as appropriate to 1:10 or 1:20.

7.8.17 Site plans shall identify both London Grid and OS co-ordinates. 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.

7.8.18 Section drawings shall be located on the relevant plan and both London Grid and OS co-ordinates recorded. The locations of the OSBM or PGM bench markers used and any site TBM shall also be indicated.

7.8.19 A record of the full extent in plan of all archaeological deposits as revealed in the investigation shall be made; these plans shall be on polyester based drawing film, and be at a scale of 1:10 or 1:20 unless otherwise agreed with the Project Archaeologist. 'Single context planning' shall be used on deeply stratified sites. Drawing information

shall be digitised for eventual CAD applications. The GLSMR will accept Autocad DXF or .DWG format of extent of site and location of major features with the completed Sites and Monuments Report Form.

- 7.8.20 A 'Harris matrix' stratification diagram shall be employed to record stratigraphic relationships (Harris 1993). This record shall be compiled and fully checked by the Archaeological Contractor during the course of the excavations. Spot dating shall be incorporated onto this diagram during the course of excavations.
- 7.8.21 Recording of structural evidence revealed below ground level will vary according to the level of special interest of the structure and its relationship to below-ground archaeology. Structures of little or no significance shall be noted on a site plan. Detailed element detail drawings of important features revealed in investigations may be required in accordance with the aims and objectives of the investigation.
- 7.8.22 The Archaeology Contractor shall agree the appropriate level of recording and analysis for discovered standing structures with the Project Archaeologist, in accordance with the Crossrail procedure for non-listed built heritage recording (Document CR-PN-PRW-EN-PD-00010). The Archaeology Contractor shall revise the Archaeological Contractor's Method Statement to reflect any additional requirements for built heritage recording.
- 7.8.23 The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format SLR camera (film or digital) is acceptable for all site photography. The Archaeology Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, and structures. Each photograph and transparency shall clearly show details of the above, and may require the use of artificial lighting to achieve suitable definition. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the project event code and context/feature number. In addition, the Archaeology Contractor shall take appropriate record photographs to illustrate work in progress.
- 7.8.24 The transparencies shall be mounted in suitable frames for long-term curation in preparation for deposition with the archive. Digital photography and video recording may be appropriate in some circumstances and the Archaeology Contractor shall set out proposals for such recording in the Archaeology Contractor's Method Statement for approval by the Project Archaeologist.
- 7.8.25 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 SS-WSI and addressed in the Archaeology Contractor's Method Statement.

## **7.9 Archaeological science**

- 7.9.1 The strategy for sampling archaeological and palaeo-environmental deposits and structures (which can include soils, timbers, pollen, diatoms, animal bone, human bone etc.) will be developed by the Project Archaeologist in consultation with English Heritage Science Advisor and the Archaeology Consultant. On-site work and off-site analysis of the processed samples and remains will be undertaken by the Archaeology Contractor's

environmental archaeologist as specified in the Archaeology Contractor's Method Statement.

- 7.9.2 The finds retrieval policies of the appropriate recipient museum will be adopted. In accordance with the collection and retention strategy set out in SS-WSI, all finds (artefacts and ecofacts) visible during excavation shall be collected and processed by the Archaeology Contractor. In some cases, sampling may be the most appropriate strategy. Finds shall be appropriately packaged and stored under optimum conditions, as detailed in the RESCUE/UKIC publication First Aid for Finds (Watkinson and Neal 1998).
- 7.9.3 Where 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 the Centre for Archaeology Guideline on Archaeometallurgy (English Heritage 2001). Assessment of any technological residues shall be undertaken.
- 7.9.4 Where appropriate, samples shall be taken for scientific dating (for example radiocarbon dating, OSL, thermoluminescence at the evaluation stage). This may apply where dating by artefacts is insecure or absent, and where dating is necessary for development of the SS-WSI for subsequent mitigation strategies. Procedures and specifications shall follow English Heritage guidance (English Heritage 2008b).
- 7.9.5 Buried soils and sediment sequences shall be inspected and recorded on site by the Archaeology Contractor's geoarchaeologist, since field inspection may provide sufficient data for understanding site formation processes. Procedures and techniques presented in the English Heritage documents Environmental Archaeology (English Heritage 2002) and Geoarchaeology (English Heritage 2007) shall be followed. Samples for laboratory assessment shall be collected where appropriate, following agreement with the Project Archaeologist.
- 7.9.6 Deposits shall be sampled for retrieval and assessment of the preservation conditions and potential for analysis of biological remains following English Heritage guidance (English Heritage 2002). The sampling strategy shall include a reasoned justification for selection of deposits for sampling, and shall be developed by the Archaeology Contractor's environmental archaeologist or recognised bioarchaeologist in liaison with the Project Archaeologist. Flotation samples and samples taken for coarse-mesh sieving from dry deposits shall be processed at the time of the fieldwork wherever possible, to permit variation of sampling strategies if necessary. Sampling strategies for wooden structures shall follow the methodologies presented in Brunning (1996).
- 7.9.7 Artefacts, biological samples and soils shall be assessed for evidence of site and deposit formation processes and taphonomy and especially for evidence of recent changes that may have been caused by alterations in the site environment.
- 7.9.8 Assessment of finds assemblages shall include x-radiography of all iron objects (after initial screening to exclude obviously recent debris) and, where appropriate, non-ferrous 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.
- 7.9.9 Once assessed, all material shall be packed and stored in optimum conditions, as described in First Aid for Finds (Watkinson and Neal 1998). Waterlogged organic

materials shall be processed in accordance with: Guidelines for the care of waterlogged archaeological leather (English Heritage/Archaeology Leather Group 1995) and Waterlogged wood: the recording, sampling, conservation and curation of structural wood (Brunning 1996).

- 7.9.10 Samples for absolute dating shall be submitted promptly to the supply laboratory proposed by the Archaeology Contractor or other supplier as instructed by the Project Archaeologist. Delivery times shall be agreed to ensure that the results are available to aid development of specifications for subsequent mitigation strategies in the SS-WSI. Where it is proposed to date human remains, the time limits for reburial imposed by Schedule 15 of the Crossrail Act (for remains removed from burial grounds) or set out in the relevant burial licence under the Burial Act 1857 (in all other cases) shall be adhered to.
- 7.9.11 Processing of all soil samples collected for biological assessment, or sub-samples of them, shall be completed as soon as reasonably practicable. The preservation state, density and significance of material retrieved shall be assessed by the Archaeology 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. Unprocessed sub-samples shall be stored in appropriate conditions in accordance with the Archaeology Contractor's Method Statement.
- 7.9.12 Samples collected for geo-archaeological assessment shall be processed promptly by the Archaeology Contractor's specialist, particularly where storage of unprocessed samples is thought likely to result in deterioration. Appropriate assessment shall be undertaken as agreed with the Project Archaeologist. Where preservation in situ is a viable option, 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 (English Heritage 2002).
- 7.9.13 Animal bone assemblages, or sub-samples of them, shall be assessed by the Archaeology Contractor's specialist with reference to English Heritage guidance (English Heritage 2002).
- 7.9.14 The results from any specific investigations in Archaeological Science shall be included in the Site Archive and presented in the evaluation report or final fieldwork report. Reports shall include sufficient detail to permit assessment of potential for analysis. They shall include tabulations of data in relation to site phasing and contexts, and include non-technical summaries. The objective presentation of data shall be clearly separated from interpretation i.e. recommendations for further investigations, (both on samples already collected, and at future excavations), shall be clearly separated from the results and interpretation.

#### **Generic specification for Environmental Sampling**

- 7.9.15 Appropriate features and deposits shall be sampled to retrieve palaeo-environmental and economic indicators. The Archaeology 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 SS-WSI.
- 7.9.16 The Archaeology Contractor shall use ten litre plastic buckets (with lids and handles), or as a temporary measure 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.

- 7.9.17 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. IFA Standard and Guidance for Artefact and Environmental Study, Collection, Research and Conservation 2008d; English Heritage –Geoarchaeology, 2007; English Heritage - Archaeological Science at PPG16 interventions: Best Practice Guidance for Curators and Commissioning Archaeologists, 2003).
- 7.9.18 The Archaeology Contractor shall be responsible for the protection of all samples and finds and for their transport (including loading and unloading) to the Archaeology Contractor's facilities or other location as agreed with the Project Archaeologist. Samples shall be protected at all times from temperatures below 5 and above 25 degrees Celsius and from wetting and drying out due to weather exposure.
- 7.9.19 Bulk samples shall normally be in the range of 10-60 litres. The size selected will depend on the likely density of macrofossils in the soil. The lower end of the range (10-20 litres) will be suitable for the recovery of macrofossils from waterlogged deposits. For non-waterlogged deposits the sample volume is likely to be in the middle to higher range (20-40 or 40-60 litres) dependant upon site activity, conditions and preservation. The residue of soil left in the bottom of any inhumations after the removal of human remains shall be retrieved for bulk processing. Vessel or pit fills containing human remains shall be processed as bulk samples to ensure the maximum retrieval of cremated bone. Cremation vessels and deposits of placed human bone within cut features may require excavation in spits. The fill residues from the excavation of these features shall be bulk sampled to ensure maximum retrieval of cremated bone, associated small finds and floral and faunal remains. All work shall be undertaken in compliance with the generic Crossrail standards for Human Remains (see Section 7A) which may require the reburial of human remains within a specific timeframe.
- 7.9.20 For 'bulk disturbed' samples the limits of the sample zone shall be recorded and identified on plan.
- 7.9.21 The Archaeology Contractor shall use appropriately sized monolith or kubiena boxes for the recovery of 'undisturbed' monolith samples for geo-archaeological study (pollen, other microfossil and micromorphological studies etc). 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 Archaeology 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.
- 7.9.22 The Archaeology 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. Where the sample

crosses archaeological context boundaries these shall be noted on the sample recording pro-forma.

7.9.23 Where it is not possible to insert monolith boxes, the Archaeology 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.

7.9.24 Where appropriate, the Archaeology Contractor shall take contiguous column samples for the retrieval of macrofossils. 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 sub-samples for a range of palaeo-environmental evidence, for example, insects, molluscs and seeds, to ensure that adequate sub-samples are available for specialist assessment.

## **8 Deliverables**

### **8.1 C254 Archaeology Contractors Deliverables**

8.1.1 The Archaeology Contractor shall provide a detailed Archaeological Method Statement for the archaeological general watching brief.

8.1.2 During the execution of each fieldwork event the Archaeology Contractor shall submit a weekly progress report to the Project Archaeologist.

8.1.3 On completion of each archaeological fieldwork event the Archaeology Contractor shall provide the post-excavation deliverables summarised below:

- a Survey Report within 2 weeks of completion;
- a Fieldwork Report within 6 weeks of the completion; and
- a Summary Report within 8 weeks of the completion.

8.1.4 The requirement for production of a formal Post-excavation Assessment will be dependent on the significance of the results of the general watching brief undertaken during the C807 breaching works.

8.1.5 Details of each deliverable are provided below.

### **8.2 Archaeological Contractors Method Statement**

8.2.1 The Archaeology Contractor shall provide a detailed Method Statement for the works for the Project Archaeologist's approval. The Method Statement shall be prepared in association with the Principal Contractor, taking account of their Environmental Management Plan and other relevant site information provided by them and requirements for the works set out in the Works Information (e.g. relating to health and safety, security, engineering design requirements and attendances). The Method Statement must be approved by Crossrail and issued to the Principal Contractor via the

Enterprise Bridge (eB) document control system no later than 4 weeks before breach day (11 July 2015). The Method Statement shall include, as appropriate:

- a) A resource plan and programme and CV's;
- b) The Archaeology Contractor's IT capability and proposed IT plan (including specific survey methods for on-site recording of stratigraphic profiles and sub-surface topographic modelling;
- c) The Archaeology Contractor's approach to Archaeological Science;
- d) The methods for survey and setting out works;
- e) The methods to address the specific event types required (trial trench, area excavation etc);
- f) The safe method of working whilst excavating trenches or pits including any temporary works required;
- g) The method for disposing of water from trenches and test pits in waterlogged ground;
- h) Site management plan to include details of the method for preparing safe access route to the working areas, the proposed site accommodation, services and welfare;
- i) The retention and disposal policies for samples and artefacts recovered during the work;
- j) The method for excavating and recording inhumations and cremations in compliance with the generic Crossrail standards for Human Remains (see Section 7.1);
- k) The method for preparation of the required reports, archive and all associated deliverables;
- l) The procedures for assessment of potential for analysis (post excavation assessment);analysis and publication proposals;
- m) The method for preparation of the digital dataset, digital drawings, and digital report deliverables;
- n) The Archaeology Contractor's methods and approach for undertaking the site based works and off site processes to completion.
- o) The Health and Safety Plan and Site-Specific Risk Assessment (including unexploded ordnance);
- p) The Quality Assurance Plan;
- q) The procedures for on- and off- site security and emergency response plan (including environmental incidents);
- r) The method for complying with project generic and site specific environmental and consent requirements; and
- s) The Archaeology Contractor's requirements and specification for services and facilities and attendances required to be supplied by the Principal Contractor or the Employer.

### **8.3 Site Archives**

- 8.3.1 The site archive shall be organised to be compatible with other archaeological archives in London, or where outside the greater London area, any specific requirements of the receiving museum. This requirement for archival compatibility includes computerised databases.
- 8.3.2 For London archives, individual descriptions of all archaeological strata and features excavated or exposed shall be entered onto prepared pro-forma recording sheets which include the same fields of entry on the recording sheets of Museum of London Archaeology. Sample recording sheets, sample registers, finds recording sheets, registered finds catalogues and photographic record cards shall also follow the Museum of London Archaeology equivalents.
- 8.3.3 Archives shall be prepared to conform with current best practise (e.g. Brown and Duncan 2007; Institute of Field Archaeologists 2008f) The archive shall cover all finds, samples and records (drawn, written, photographic and electronic) collected and produced during the works. The archive shall be indexed and internally consistent. The Archaeology Contractor shall complete the site archive and submit to the Project Archaeologist within 8 weeks of completion of a fieldwork event.
- 8.3.4 The site archive shall be deposited by at a museum to be confirmed by the Project Archaeologist.

### **8.4 Digital Data**

- 8.4.1 The Archaeology Contractor shall produce a digital data archive of all primary field data produced during the works in accordance with ADS guidelines (Richards and Robinson 2001).
- 8.4.2 The Archaeology Contractor shall prepare and provide field and laboratory data, evaluation or excavation trench and phasing plans showing archaeological features recorded, and report text in digital form, as well as in paper form. Consideration should be given to recording electronic plans during fieldwork.
- 8.4.3 The digital archive for each fieldwork event shall be copied to CD-R or DVD (recordable laser disc) and submitted to the Project Archaeologist for archiving in the Employer's document management system.
- 8.4.4 Final reports, site plans and other illustrations shall be prepared in accordance with the Employer's Information Management standards and procedures.
- 8.4.5 All data files submitted shall be scanned by a virus detection programme updated to the most current version. The disk label shall clearly indicate:
- Confirmation that this check has been carried out (including details of the virus checking programme name and version used) and that the submission is virus free.
  - Fieldwork event name and code.

- 8.4.6 Supplier company name, date and QA details (as a minimum, the name, position and signature of the approver).
- 8.4.7 Prior to commencing the works, the Archaeology Contractor shall submit an example hard copy and data output of each of the data formats required (i.e. data, graphic, CAD and text) produced by their current software, for approval by the Project Archaeologist. The Archaeology Contractor shall inform the Project Archaeologist of any changes or upgrades made to approved software prior to processing any works data. The sample disk shall include data from a previous real job or jobs.
- 8.4.8 A sequential numbering of data issues shall be rigorously adhered to so that no data versions are submitted out of sequence. The organisation of the data prior to submission shall be the responsibility of the Archaeology Contractor. The Archaeology Contractor shall ensure that data originating from different sources within the Archaeology Contractor's organisation is compatible with the project requirements. The Archaeology Contractor shall nominate one person to the Project Archaeologist who is the main point of contact for matters relating to the digital data submissions.
- 8.4.9 Where errors or inconsistencies are noted in the data, by either the Project Archaeologist or Archaeological Contractor they shall be corrected by the Archaeology Contractor and a corrected data file issued to the Project Archaeologist. When a change or addition is made to the data within an issue, a complete data group shall be re-issued, not just the changed fields. This may not require complete replacement of the whole data set which includes other previous issues.
- 8.4.10 Where any changes are made to a data record between digital data submissions, the Archaeology Contractor shall record the date of the change and the name of the person carrying out the change. The Archaeology Contractor shall ensure that each data amendment is carried out correctly.
- 8.4.11 The Archaeology Contractor shall make two identical copies of the digital archive. The first copy shall be retained by the Archaeology Contractor until the expiry of the Contract maintenance period. The second copy shall be issued to the Project Archaeologist.
- 8.4.12 A digital archive for each Crossrail site (incorporating individual event archives) shall be submitted to a regional or national data archive as agreed with the service provider by the Employer.

## **8.5 Interim Statement**

- 8.5.1 Within 7 days of completion of a fieldwork event the Archaeology Contractor shall submit an Interim Statement to the Project Archaeologist.
- 8.5.2 The Interim Statement shall be brief, and the information contained commensurate with the timescale for production. The report shall not duplicate effort to be utilised at a later date and shall draw on the data gathered during the initial assessment undertaken during fieldwork.
- 8.5.3 A site plan indicating all as-dug investigations shall be provided. Key stratigraphic profiles and topographic templates of the major stratigraphic units shall be provided.
- 8.5.4 The Interim Statement including illustrations shall be submitted as a single PDF file to the Project Archaeologist. CAD drawing files shall also be submitted.

- 8.5.5 The Interim Statement text shall be submitted in hard copy and as an MS Word \*.document in accordance with the Employer's information management standards and procedures.
- 8.5.6 The Interim Statement shall include an approved report title sheet and QA page (to be supplied by the Employer).
- 8.5.7 The following shall appear in the footer or header of each Interim Statement:  
© CRL Ltd, 20\$\$
- 8.5.8 Copies of the Interim Statement shall be provided by the Project Archaeologist to the Historic Environment Advisors at ECC for comment.

## 8.6 Survey Report

- 8.6.1 The Archaeology Contractor shall provide a written and graphic survey report for the works upon completion of fieldwork. Evidence shall be provided for check measurements and results of levelling for establishment of TBM's. The survey report shall be submitted by the Archaeology Contractor to the Project Archaeologist within 2 weeks of the completion of fieldwork.
- 8.6.2 The Archaeology Contractor shall prepare and submit 'as excavated' site area outlines and levels in accordance with Crossrail standard CRS-SDT-05. Each drawing shall identify the relevant event code and sub-site division, if applicable.

## 8.7 Fieldwork Report

- 8.7.1 The evaluation report and watching brief reports shall be prepared by the Archaeology Contractor within 6 weeks of the completion of the fieldwork (unless this is varied by the Project Archaeologist). The Fieldwork Report shall follow the standard structure set out in City of London Planning Advice Note 3 and IFA standards i.e.:

### Contents list

Non technical summary

1. Introduction
2. Planning background
3. Previous work(s) relevant to archaeology of site (DBA, DDBA, surveys etc)
4. Geology and topography of site
5. Research objectives and aims
6. Methodology of site-based and off-site work
7. Results and observations including quantitative report, stratigraphic report (including any constraints on site).
8. Assessment of results against original expectations (using criteria for assessing national importance i.e. period, relative completeness, condition, rarity, and group value) and review of evaluation strategy

9. Statement of potential of archaeology
10. Conclusions and recommendations for appropriate mitigation strategy
11. Publication and dissemination proposals (in addition to fieldwork report)
12. Archive deposition
13. Bibliography
14. Acknowledgements
15. Sites & Monuments Record form
16. A3 plans

- 8.7.2 The Fieldwork Report shall provide an illustrated factual statement and statement of importance with associated assessment of potential for further fieldwork and/or analysis of the archive. The Fieldwork Report shall utilise information collected during archaeological fieldwork and from any other appropriate sources agreed with the Project Archaeologist.
- 8.7.3 The Fieldwork Report shall include sections detailing the background to the project, any previous relevant research and investigation, location and topography/geology, a description of the methodology employed and the techniques adopted. Where relevant, these sections shall include location plans with scale and grid co-ordinates.
- 8.7.4 Each component of the works (e.g. stratigraphic/structural, artefactual and environmental/economic) shall be supported by a statement setting out:
- A quantification of the resource (tabulated and cross referenced as appropriate);
  - Provisional dating and evidence for residuality and intrusiveness;
  - The range of material, including sampling and/or taphonomic biases; and
  - The condition of the material, including preservation bias.
- 8.7.5 The stratigraphic statement shall include: a description of the geomorphology and sedimentation record of the survey area; a description of the fieldwork results (brief context descriptions supported by plans and sections as necessary, with levels related to Ordnance Datum); a trench summary table indicating depths of all major stratigraphic units, and their boundaries. Photographs shall be included where appropriate.
- 8.7.6 The Archaeology Contractor shall produce a subsurface model(s) and profiles to illustrate the extent, character and depth of the major stratigraphic topology identified. The model shall be correlated with previous works within the survey area in order to inform the mitigation design. The processing software and presentation format of the data shall be included in the Archaeology Contractor's Method Statement for approval by the Project Archaeologist.
- 8.7.7 The assessment of results and statement of potential shall include the Archaeology Contractor's conclusions based on the recorded data, e.g. the monument/site class represented, site/feature function and relevant parallels. The statement shall also comment on the potential of the data to address the projects' research themes. As appropriate, comment shall be made on the site as a whole and the individual

components (e.g. artefactual, palaeo-environmental, economic). The statement shall utilise the criteria laid down by the Secretary of State for Culture, Media and Sport Criteria for Scheduling, to establish importance.

- 8.7.8 In reporting the results of the works, the accuracy of the original expectations and the appropriateness of the methods adopted shall be assessed by the Archaeology Contractor in order to illustrate what level of confidence can be placed on the information. The Project Archaeologist will use that information as the basis for developing any further mitigation strategy and/or further analysis and publication.
- 8.7.9 The report shall be illustrated with a site location plan, survey location plans as appropriate (to include archaeological interpretation of results), and individual trench and area plans identifying archaeological features exposed and investigated.
- 8.7.10 When submitted at evaluation stage, the report shall set out an outline recommendation for mitigation. This may include preservation in situ and/or further investigation and recording of the remains and/or watching brief. The development of a detailed mitigation strategy shall be progressed by the Project Archaeologist in liaison with the Project Manager's engineering design team, the Archaeology Contractor, and the English Heritage Science Advisor (and other statutory authority), as appropriate.
- 8.7.11 Copies of the Fieldwork Report shall be provided by the Project Archaeologist to the Historic Environment Advisors at ECC for comment.
- 8.7.12 The following shall appear in the footer or header of each Fieldwork Report:

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## **8.8 GLSMR Summary Sheet**

- 8.8.1 The Archaeology Contractor shall complete a GLSMR Summary Sheet for the works (i.e. one per fieldwork event). The Summary Sheet shall be included in the Fieldwork Report.

## **8.9 Summary Report**

- 8.9.1 A short summary report of no more than 500 words (the Summary Report) for the works shall be prepared by the Archaeology Contractor for submission to the Project Archaeologist for subsequent publication within London Archaeologist or another local (county) journal or publication outlet specified by the Project Archaeologist.
- 8.9.2 The Archaeology Contractor shall submit the draft Summary Report to the Project Archaeologist for approval within 8 weeks of the completion date of the fieldwork event. The Archaeology Contractor shall allow two weeks in the programme of works for the Project Archaeologist to provide comments. The Archaeology Contractor shall include any amendments required by the Project Archaeologist in the final Summary Report which shall be submitted within one week of receiving the Project Archaeologist's comments on the draft report.
- 8.9.3 The Summary Report shall be submitted as an MS Word \*.document in accordance with the Employer's information management standards and procedures.

## **8.10 Post excavation assessment**

- 8.10.1 If instructed by the Project Archaeologist, the Archaeology Contractor shall undertake a post-excavation assessment of the site archive and submit a report of their findings to the Project Archaeologist for approval. Assessment of potential for analysis shall be undertaken in accordance with English Heritage guidelines.
- 8.10.2 The Archaeology Contractor shall provide details of its current post excavation assessment procedures with their Method Statement.

## **9 Site Monitoring & Progress Reports**

- 9.1.1 Prior to commencing the works the Archaeology Contractor shall agree a programme of weekly written progress reports and periodic progress meetings with the Project Archaeologist and/or Project Manager and shall be represented at such meetings to the satisfaction of the Project Archaeologist. The Archaeology Contractor shall provide information describing progress on-site to date, the processing of samples and artefacts and feedback from any initial assessment.
- 9.1.2 The Historic Environment Advisors at ECC shall be informed in writing at least one week in advance of commencement of fieldwork by the Project Archaeologist.
- 9.1.3 Periodic updates on the progress of the Crossrail archaeology programme shall be submitted to the Historic Environment Advisors at ECC by the Project Archaeologist. The Archaeology Contractor shall provide information to the Project Archaeologist as requested to inform this reporting.
- 9.1.4 The Project Archaeologist shall arrange and convene monitoring site visits by the Historic Environment Advisors at ECC, as appropriate. There shall be no unauthorised access to the works in any other circumstances. Any visits to the works shall be in accordance with the Principal Contractor's health and safety, site access and security requirements.
- 9.1.5 The Archaeology Contractor may propose that archaeological excavation be carried out as an extension to evaluation works, if the scope of such work is readily incorporated into the SS-WSI. The detailed method for this work shall be agreed between the Archaeology Contractor and the Project Archaeologist at a site meeting and subsequently in writing between the Project Archaeologist and the relevant external consultees.

## 10 Personnel Requirements

- 10.1.1 The Archaeology Contractor shall provide project personnel of experience as described below. The personnel shall be approved by the Project Archaeologist. Approval may be withdrawn by the Employer at their discretion and in accordance with the contract conditions.
- 10.1.2 The Archaeology Contractor shall submit CVs of all proposed personnel including any specialists, but excluding site technician grades, to the Project Archaeologist for approval if this has not already been done as part of the pre-qualification process.
- 10.1.3 The works shall be managed, directed and staffed by appropriately qualified and experienced personnel. The Archaeology Contractor's Key Person shall possess at least ten years relevant experience.
- 10.1.4 The excavation, sampling and recording of the works shall be directed in the field by a Fieldwork Director who is a Member of the Institute of Field Archaeologists (MIFA) The Fieldwork Director shall be on site throughout the fieldwork stages.
- 10.1.5 The Archaeology Contractor's project team shall include an environmental archaeologist suitably qualified in archaeological science and geo-archaeological sediment description methods, and on site sample processing and assessment techniques.
- 10.1.6 The Archaeology Contractor's project team shall be staffed by technician grades with minimum six months experience in appropriate aspects of excavation and recording.
- 10.1.7 Specialist staff employed on any aspect of the works, including post-excavation assessment or analysis of any kind including the writing of reports, shall be suitably qualified and shall be supervised by personnel with a minimum of ten years of relevant experience in their field (this may be inclusive of post-graduate studies).
- 10.1.8 Specialist staff shall be available, normally at 24 hours notice, for the duration of the works to provide advice on any specialist tasks to be undertaken.

## 11 References and Glossary of Terms

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## 12 Annexes

### Annex 1 Archaeological Research Agenda

The aims, objectives and relevant archaeological research agenda as set out in the Greater Thames Estuary Historic Environment Research Framework - Update and Revision (ECC FAU 2010) are presented in Section 4 of this site specific WSI and major research themes summarised from Framework Object 3B below:

- Developing an overview of the evolution of sea defences in relation to sea-level and climatic change.
- Developing an understanding of the construction methods of seawalls and their water control mechanisms.
- Developing an understanding of the historical context of sea defences in terms of secular and ecclesiastical land ownership and exploitation.
- Establishing a chronological framework for the development of sea defences.

### Annex 2 Site Information

#### Services and Utilities

The C807 Principal Contractor will advise the C254 Archaeological Contractor of the latest works information regarding the location and depth of all known services and utilities prior to the start of the archaeological works.

#### Extinguishments of Rights of Way

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

#### Surface Water Control

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

#### Protective Fencing

Site security and protective fencing is the responsibility of the C807 Principal Contractor.

#### Credit Boards

For further information please refer to the Works Package Information for the C254 Archaeological Contract.



### Care in Executing the Site Operations

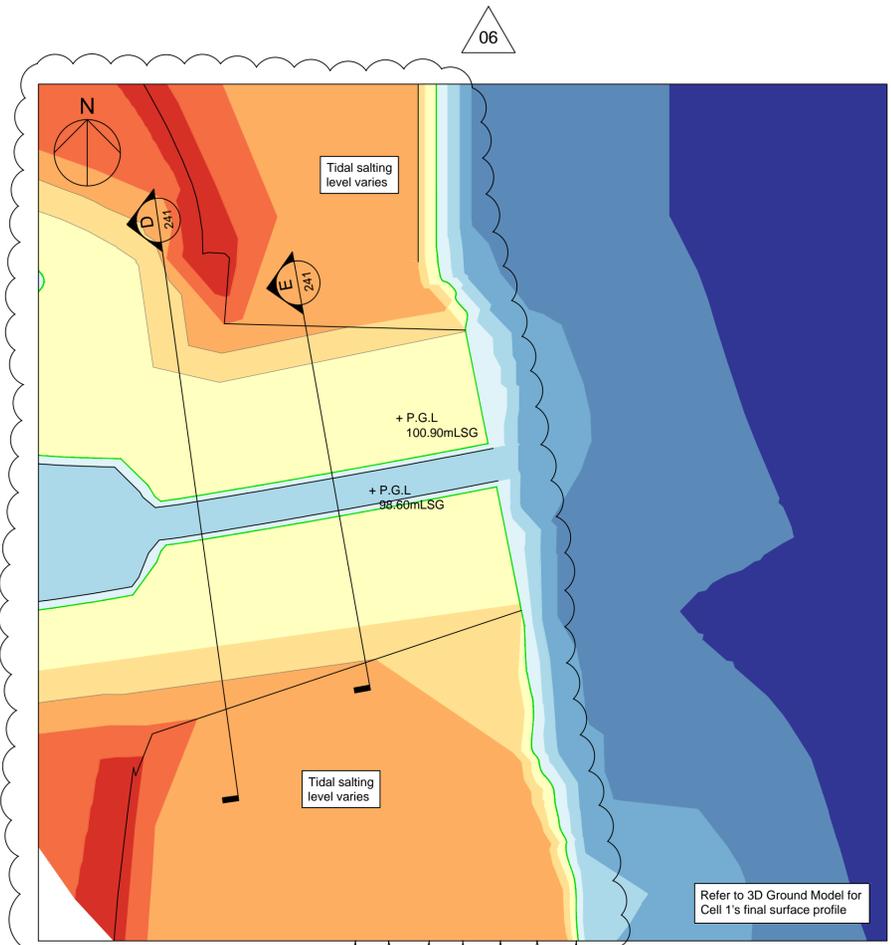
For further information please refer to the Works Package Information for the C254 Archaeological Contract.

### Parking of Vehicles

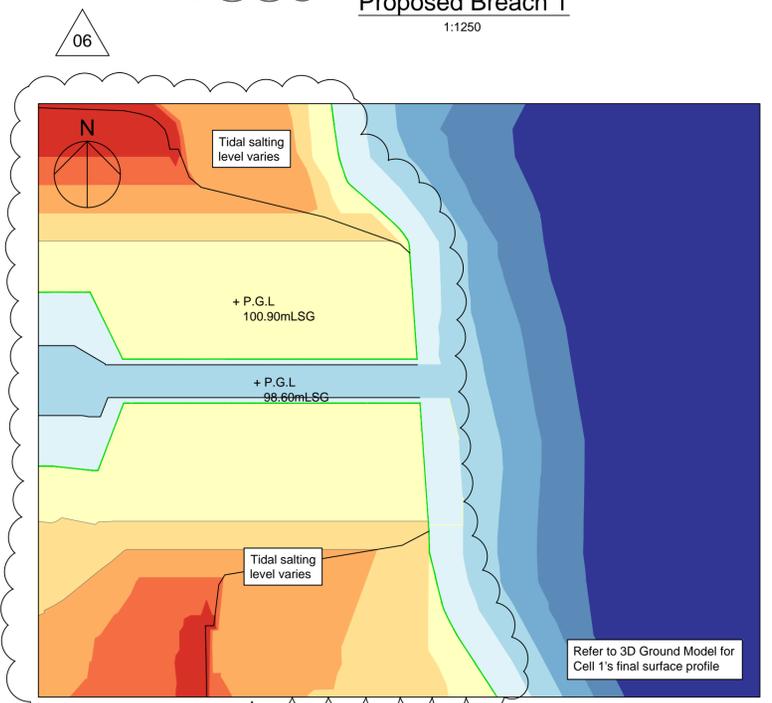
For further information please refer to the Works Package Information for the C254 Archaeological Contract.

### Annex 3 Plans and other Illustrations

Drawing Number	Title	Scale
C176-FAB-C-DWG-CRT00_ES001-50017	Proposed Breach	1:1250@A1



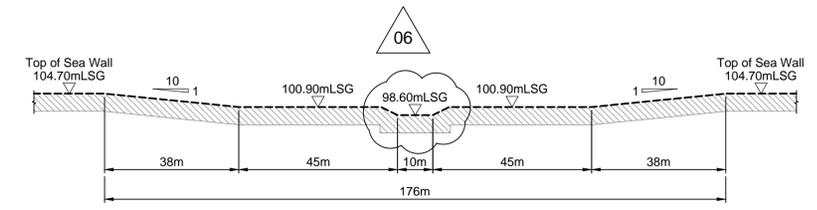
**Proposed Breach 1**  
1:1250



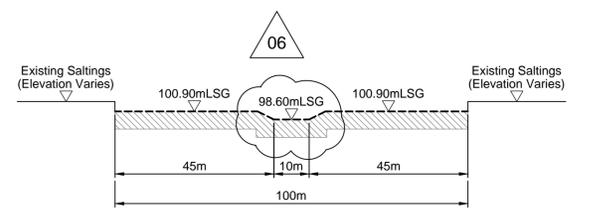
**Proposed Breach 2**  
1:1250

Tidal Range	mAOD	mLSG
HAT	3.25	103.25
MHWS	2.85	102.85
MHWN	1.85	101.85
MLWN	-1.35	98.65

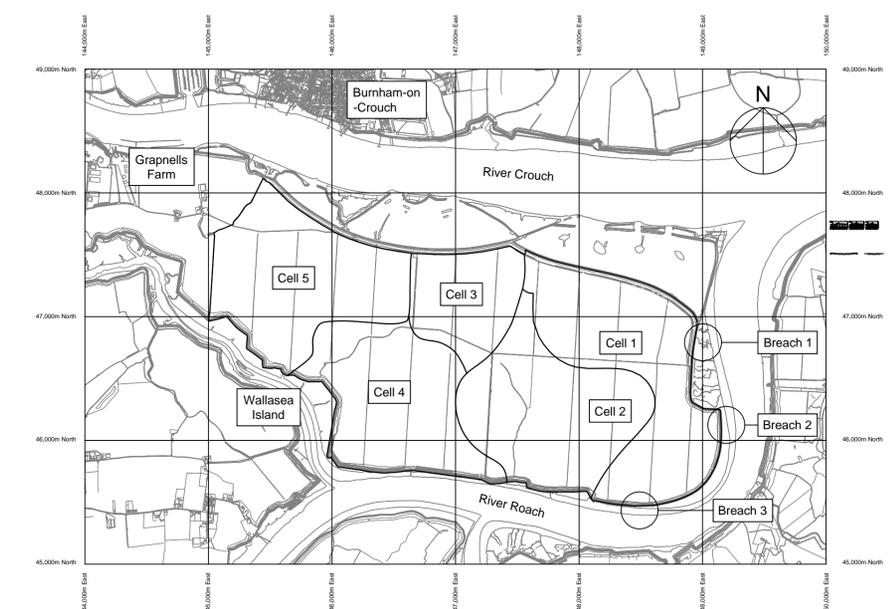
Latest information available from Harbour Authority



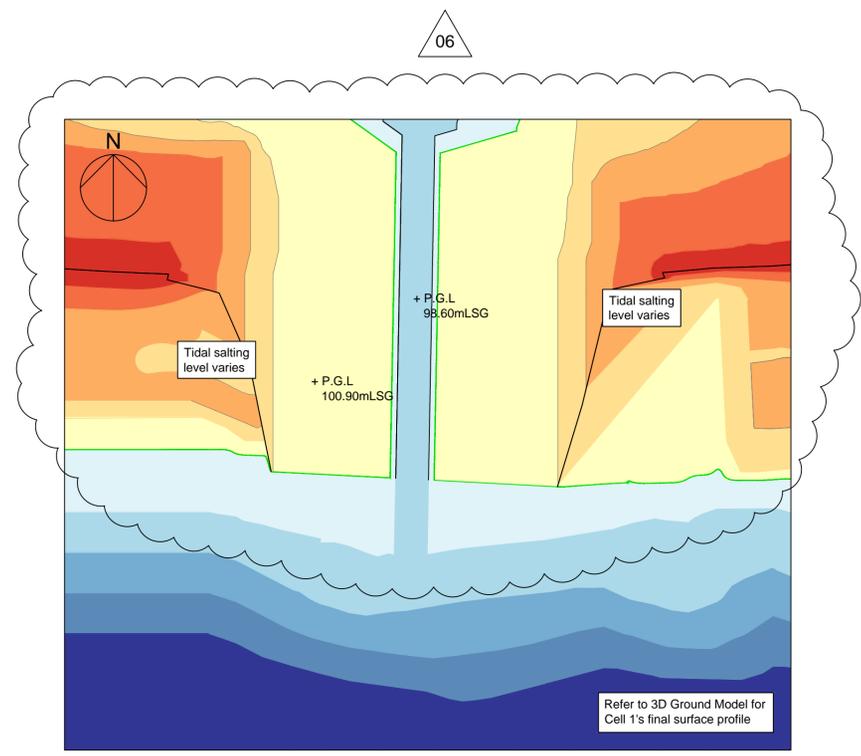
**Typical Cross Section Through Seawall Breach** (D)  
1:1000



**Typical Cross Section Through Tidal Saltings** (E)  
1:1000



**Location Plan Including Future Cells**  
N.T.S.



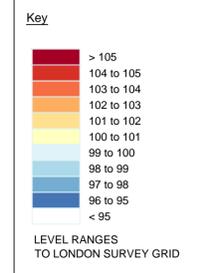
**Proposed Breach 3**  
1:1250

**Safety, Health and Environmental Information**

- Notes below are additional to hazards/risks associated only with earthworks:
- Construction - Earthworks
    - Ci. Very soft mud/clays underlay the site, high water table poses risk to trafficability of plant around site.
    - Cii. Sides of existing drainage and soke dykes may be too weak for plant.
    - Ciii. Land drains exist throughout site, interception may weaken the embankment.
    - Civ. Farm will continue to operate during works, inexperienced drivers may be present during harvest. Clear signage required in working area.
    - Cv. Public footpath is present on the crest of the seawall and over conveyor culvert. Will require exclusion fencing and signage during works to prevent public access to working area.
    - Cvi. Site access / egress shall be laid out and signed to ensure the safety of other road users.

- Construction - Breaching
  - Cvii. The breaching works will expose operatives to the hazards of working in tidal zones and on formations that are likely to be of insufficient strength to support plant. Hazards that must be managed include: \* Drowning \* Formation collapse under plant.
  - Cviii. Breaching works are considered the first step in operating the site.
  - Cviii. There will be tidal working during the breach of the seawall and may increase the hazard referred to in Ci above. Before any work commences the Principal Contractor shall submit its proposals to the CDM Coordinator for discussion.
  - Cix. The breaching works may restrict evacuation routes for plant and operatives undertaking the works. The Principal Contractor shall note the tide levels indicated on the drawing. Tide charts are available - see Specification Clause 1.39.
  - Cx. Lifting stop logs into/out of structure will be in presence of public.
  - Cxi. Contamination of estuary from breach works.
  - Cxii. Structures to be left in 'closed' position until completion of Cell 2 and 3. Structure to be opened after Cell 2 and 3 is under tidal influence.
  - Cxiii. Sufficient geotechnical information about the area for breaching works may not be available. (Method statement specific ground investigation may be necessary).
  - Cxiv. Access to lower areas of structures will be under tidal influence.

**Emergency Evacuation:**  
The working formation may not be suitable for use by emergency vehicles. These notes are based on the use of experienced and competent contractors carrying out the work using an approved safe method of working.



Rev.	Date	Description	By	Chkd	App	Auth
06	18/08/14	Cell 1 ground model updated. For Construction.	MKW	PE	AZ	SPC
05	28/08/12	Construction Re-issue Following RFI Meeting.	JW	RL	RL	VH
04	25/04/12	Issued for Construction.	JW	GP	RL	VH
03	26/10/11	Sections D and E moved from drawing 60148989-3519-241.	CW	GP	VH	VH
02	21/09/11	Issued for Tender.	CW	LM	VH	VH
01	16/12/10	Amendments based on meeting comments as of 30/11/10.	CW	LM	VH	VH
00	25/05/10	Issued for Comment.	CW	LM	VH	VH

- Notes**
- Confirmation of all survey data must be obtained from the Crossrail survey team.
  - Coordinates to the London Survey Grid, heights to the London height datum which is 100 metres below Ordnance Datum Newlyn. See Crossrail standard CR-STD-010.
  - All dimensions are in millimetres unless specified otherwise.
  - Do not scale from this drawing.
  - Benchmark levels from Capital Surveys Ltd 1735 (dated 25th March 2009)
  - Existing levels based on CRL Survey supplied - Document 10100-g0g00-s01-a-50001. The Contractor shall check and then agree on site with the Supervisor all existing and proposed levels prior to construction.
  - This drawing to be read in conjunction with Technical Specification. The Specification for the Works is the Civil Engineering Specification for The Water Industry 6th Edition by UKWIR together with the special clauses contained in the

- Technical Specification.**
- It is the responsibility of the Contractor to confirm the position and level of services. Whilst working adjacent to and around services the Contractor shall comply with the requirements of the Statutory Undertakers and the Health and Safety Executive Guidance Note HS(E)47 avoiding danger from underground services.
  - The Contractor shall excavate drainage grips as required to enable surface water to drain from all excavations. Prior to any breaching all grips shall be backfilled to adjacent ground level unless instructed otherwise by the Supervisor.
  - No trees on site. Existing site is approximately 101m LSG flat farmland.
  - All weather haul road to connect to existing concrete track (4.0m width) as repeated passes on soils will result in deep rutting.

- Concrete revetment (not shown) exists on riverward face of seawall.
- Refer to drawing 60148989-3519-240 for dimensions and tide levels.

**FOR CONSTRUCTION**

Contract: **C176**  
Originator: **AECOM Ltd**  
Location: **Wallasea Island**

**Crossrail**  
25 Canada Square  
Canary Wharf  
London  
E14 5LQ

Scale: **As Noted @ A1**  
Drawing and CAD file No: **60148989-3519-241**

By: **DC**  
Chk: **LM**  
App: **VH**  
Auth: **VH**

Rev: **06**  
Stat: **Stat**

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Suitability RESTRICTED

## **Annex 4 Health and Safety Requirements**

### **Designers Risk Assessment and CDM requirements**

The archaeological works have been designed to remove or reduce risk where possible. Residual hazards and risks will be identified by the C807 Principal Contractor and communicated to the C254 Archaeology Contractor in the Principal Contractor's Method Statement for the works.

### **Archaeological Contractors Risk Assessments and Health and Safety Plans**

The C254 Archaeology Contractor will prepare method statements, site-specific risk assessments and a health and safety plan to be approved by the C807 Principal Contractor and Crossrail Central.

### **Archaeological Contractor's Safety Audits, Safety Inspections, Reporting of Accidents**

The Archaeology Contractor's requirements for safety audits, inspections and the reporting of accidents are set out in the Works Package Information for the C254 Archaeological Contract.

### **Personal Protective Equipment (PPE)**

Mandatory PPE to be worn by all C254 personnel will comprise:

- High Visibility Vest (of an appropriate colour for the nature for the Worksite);
- Hard Hat;
- Gloves;
- Light Eye Protection;
- Lace-up boots with ankle support, steel insoles and toe caps (rigger boots are not permitted on Crossrail Sites).

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

### **Labelling of Hazardous Substances, Contaminated Land**

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

### **Crossrail Health and Safety Management System, Crossrail Drugs and Alcohol Policy**

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

### **Crossrail Policy for work on Network Rail Land**

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

## **Annex 5 Environmental Protection Requirements**

For the environmental protection requirements refer to the Works Package Information for the C254 Archaeological Contract.

## **Annex 6 Programme and Order of Work for Implementation of Works and Integration with other Activities**

The programme and construction sequence for each contract package and the associated archaeological works are set out Section 6 of this site specific WSI.

## **Annex 7 Enabling and Temporary Works Design Requirements, Attendances and Implementation**

The C807 Principal Contractor will be responsible for the design of any temporary works required to enable the general watching brief and they will establish a method excavation that incorporates the archaeological general watching brief in line with the requirements for site Health & Safety and for the archaeological works set out in this SS-WSI.

The C807 Principal Contractor is also responsible for the excavation activities within the C807 Wallasea Island Cell 1. A clear, safe working area will be defined for use by C254. For construction activities requiring archaeological mitigation the C807 Principal Contractor will consult the C254 Archaeological Contractor prior to starting work.

For general and site specific security requirements at the Wallasea Island site please refer to the Works Package Information for the C254 Archaeological Contract.

## **Annex 8 Security Requirements**

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

## **Annex 9 Need for Screening or Other Protective Works**

For further information please refer to the Works Package Information for the C254 Archaeological Contract.

## **Annex 10 Procedure for Notification of the Discovery of Human Remains**

The procedure for notifying the discovery of human remains during the archaeological works are set out in Section 7 of this site specific WSI.

In the event that human remains are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and not recommence work at the location until further instruction has been received from the Project Archaeologist. The discovery of human remains will be confirmed in writing within 24 hours of discovery during which time C254 will apply for the relevant Ministry of Justice (Coroner's Division) licence.

## **Annex 11 Procedure for the Notification of the Discovery of Material Falling Under The Treasure Act 1996**

The procedure for notifying the discovery of material falling under The Treasure Act 1996 during the archaeological works are set out in Section 7 of this site specific WSI.

All finds falling within the definitions of treasure under The Treasure Act 1996 shall be reported immediately to the Project Archaeologist and all subsequent works must be undertaken in accordance with the relevant legislative requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

To protect the finds from theft, the Archaeology Contractor shall record the finds and remove them to a safe place. Where recording and removal is not feasible or appropriate on the day of discovery, the Archaeology Contractor shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor.

## **Annex 12 Procedure for Notification of Major Unexpected Discoveries**

The procedure for notifying major unexpected discoveries during the course of the archaeological works are set out in Section 7 of this site specific WSI.

In the event that archaeological remains of potentially national importance are encountered the C254 Archaeology Contractor will immediately inform the Project Archaeologist and C807 Principal Contractor. Where the remains cannot be preserved in situ a suitable scheme of investigation and recording (preservation by record) will rapidly be agreed and implemented. The scope of the archaeological recording and sampling will comply with the standard Crossrail mitigation strategy and will be proportionate to the significance of the archaeological remains discovered. The C254 Archaeology Contractor will deploy appropriate resources in order to successfully undertake the archaeological recording and sampling with minimal delay to the C807 Principal Contractor's construction programme.