



## Proposed Concrete Batching Plant, Cattedown Industrial Estate, Plymouth

Archaeological Desk-based Assessment

ADDITIONAL





**PROPOSED CONCRETE BATCHING PLANT,  
CATTEDOWN INDUSTRIAL ESTATE,  
PLYMOUTH**

**Archaeological Desk- based Assessment**

Prepared for  
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**Contents**

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Project Background .....	1
1.2	The Site .....	1
<b>2</b>	<b>METHODOLOGY.....</b>	<b>2</b>
2.1	Aims and scope .....	2
2.2	Research .....	2
2.3	Legislative and Planning Background.....	3
<b>3</b>	<b>HISTORIC ENVIRONMENT BASELINE .....</b>	<b>6</b>
3.1	Legislative and Planning Constraints.....	6
3.2	Geology and landscape development .....	6
3.3	Previous archaeological work .....	7
3.4	General archaeological background .....	8
3.5	Cave formation and cave deposits .....	8
3.6	Cave deposits – an early prehistoric archaeological resource.....	9
3.7	Worth’s Cattedown Bone Cave.....	10
3.8	Known and potential archaeology within the Site .....	11
3.9	Potential Impacts .....	12
<b>4</b>	<b>CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>14</b>
4.1	Summary .....	14
4.2	Recommendations.....	14
4.3	Further work .....	15
<b>5</b>	<b>REFERENCES .....</b>	<b>16</b>

**List of Figures**

Figure 1 Site Location

Figure 2 Map Regression

**List of Plates**

1: Viewed from Shapter’s Way looking south-west

2: North-west corner of the Site

3: View from middle of Site looking north

4: View of southern end of Site

**PROPOSED CONCRETE BATCHING PLANT  
CATTEDOWN INDUSTRIAL ESTATE  
PLYMOUTH**

**Archaeological Desk-based Assessment**

**Summary**

Hanson Aggregates commissioned Wessex Archaeology to undertake an Archaeological Desk-based Assessment to accompany a planning application (No. 06/01181/FUL) for the construction of a concrete batching plant and ancillary facilities on land off Shapter's Way, Cattedown, Plymouth (the Site) within an area of a former limestone quarry on the Cattedown peninsula.

The Site is located 70m to the east of Worth's Cattedown Bone Cave, a Scheduled Monument (SM) (No. 29678) separated from the Site by a narrow limestone bluff which survives as a remnant of the original ground level between two areas of quarrying. Deposits containing human and faunal remains of Middle to Late Upper Palaeolithic date have been recorded in fissures within this cave. These deposits are of national importance. English Heritage have indicated that there may be potential for further fissures containing similar deposits to be present within the limestone of the surrounding area.

After a consideration of the hydrological and geological resource within the area, it is reasonable to assume that natural fissures or solution features may be present within the bounds of the Site. Where present, it is also reasonable to assume that these natural features may contain faunal remains of the Devensian Glacial and, potentially, human remains or indications of human activity dating to the Upper Palaeolithic period.

The proposed development would comprise plant buildings constructed on concrete slabs supported by driven pile foundations. It is possible that the proposed foundation scheme could directly and indirectly impact potential archaeological deposits where present.

The presence and location of fissures or solution features within the Site cannot be accurately predicted using 'desk-based' techniques and further archaeological investigation of the Site will be necessary in order to try and establish the location of any such fissures in the bedrock. In the first instance, further work may entail the use of remote sensing techniques, such as geophysical survey, to establish the presence and location of any fissures within bedrock beneath the Site, subject to suitable ground conditions.

The results of this further stage of archaeological survey and consultations with the design engineer would directly inform the need for and scope of any further investigation and/or mitigation that may be possible, to reduce the potential impact of the proposed development of the archaeological resource.

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This report was researched and compiled by Abigail Bryant and the illustrations were prepared by Linda Coleman. The project was managed for Wessex Archaeology by Chris Moore.

**PROPOSED CONCRETE BATCHING PLANT  
CATTEDOWN INDUSTRIAL ESTATE  
PLYMOUTH**

**Archaeological Desk-based Assessment**

**1 INTRODUCTION**

**1.1 Project Background**

1.1.1 Hanson Aggregates commissioned Wessex Archaeology to undertake an Archaeological Desk-based Assessment to accompany a planning application (No. 06/01181/FUL) for the construction of a concrete batching plant and ancillary facilities on land off Shapter's Way, Cattedown, Plymouth centred on National Grid Reference (NGR) 249544 53667 hereafter 'the Site'.

1.1.2 The Site is located 70m to the east of Worth's Cattedown Bone Cave, a Scheduled Monument (No. 29678) separated from the Site by a narrow limestone bluff, which survives as a remnant of the original ground level between two areas of quarrying. Deposits containing human and faunal remains of Middle to Late Upper Palaeolithic have been recorded in fissures within this cave. These deposits are of national importance.

1.1.3 English Heritage have indicated that there may be potential for further fissures containing similar deposits to be present within the surrounding area, including the area occupied by the Site (**Figure 1**).

**1.2 The Site**

1.2.1 The Site is situated on Shapter's Way in Cattedown Industrial Estate, on the southern side of Plymouth (**Figure 1**). The Site covers an area of approximately 0.5 hectares, bounded to the north by the line of a fuel pipe and industrial buildings and to the east by Shapter's Way. To the south the Site is bounded by a railway line, industrial buildings and fuel storage tanks, and to the west by the rock cliff of the narrow limestone bluff supporting Higher Cattedown Road, a disused roadway running along the top of the quarry face.

1.2.2 The ground across the Site is broadly level and is currently vacant. The northern third of the Site is surfaced with tarmac. The remaining ground is covered by concrete slab and remnants of metal post foundations from previous buildings. The Site lies at approximately 10m above Ordnance Datum (aOD).

1.2.3 The proposed development would entail the construction of buildings supported by driven pile foundations. It is proposed that the main platform would be constructed on a 1200mm thick concrete slab, with ancillary buildings constructed on a 300mm thick piled concrete slab. The central

plant buildings would be bounded by a car park and lorry parks and screened from Shapter's Way by tree and shrub planting.

## **2 METHODOLOGY**

### **2.1 Aims and scope**

2.1.1 The aim of this assessment is to establish the archaeological resource within the Site and the vicinity of the Site that may be adversely impacted by the proposed development.

2.1.2 The Historic Environment Resource within the Cattedown area has been considered in order to provide a context for the discussion and interpretation of the known and potential resource within the Site (**Figure 1**).

2.1.3 A brief summary of the sources consulted is given below.

### **2.2 Research**

2.2.1 A number of publicly accessible sources of primary and synthesised information were consulted.

#### ***Legislative and Planning Documents***

2.2.2 *The Devon Structure Plan 2001 to 2016* (adopted October 2004), the *Plymouth Local Plan* (adopted 1996) and the emerging *Plymouth Local Development Plan* which should be in place by October 2007 were consulted to inform of any existing development controls relating to the historic environment. Both these documents have been prepared in accordance with national guidelines including Planning Policy Guidance Note 16 (PPG16). The results of a review of this legislation and where relevant details of any statutory designations such as Listed Buildings, Conservation Areas and Scheduled Monuments are included in **Section 3** of this report.

#### ***Documentary Sources***

2.2.3 A search of other relevant primary and secondary sources was carried out digitally and in Wessex Archaeology's own library. Recent volumes of local journals were consulted, and both published and unpublished archaeological reports relating to excavations and observations in the area around the Site were studied. The sources consulted are listed in the References section below.

#### ***Cartographic Sources***

2.2.4 A search of historic manuscript and Ordnance Survey maps was undertaken. The study of maps and other associated historical sources helps to clarify the archaeological potential of the Study Area in two ways. Firstly, it suggests aspects of the medieval and later land use prior to its modern development. Secondly, it pinpoints areas within the Study Area that, because of that development, are likely to have become archaeologically sterile. The maps relevant to the Site are listed in the References section (Section 9, below).

### **Site Visit**

- 2.2.5 The Site was visited on the 25<sup>th</sup> October 2006. The aim of the visit was to assess the general aspect, character, condition and setting of the Site and to identify any potential impacts not evident from secondary sources. Full access within the bounds of the Site was obtained. A digital photographic record of the visit was made and is held in the project archive and general images of the Site are provided in **Plates 1- 4** In this report.

### **Best Practice Guidance**

- 2.2.6 This assessment has been carried out in accordance with the Institute of Field Archaeologists' Standards and Guidance for Archaeological Desk-Based Assessment (IFA 1994 revised September 2001).

### **Assumptions**

- 2.2.7 Data used to compile this report consists of secondary information derived from varied sources, only some of which have been directly examined for the purposes of this Study. The assumption is made that this data, as well as that derived from other secondary sources, is reasonably accurate.

## **2.3 Legislative and Planning Background**

### **National Legislation and Planning Guidance**

#### **Archaeology**

- 2.3.1 The main legislation concerning the protection of important archaeological sites is the *Ancient Monuments and Archaeological Areas Act 1979* (as amended). This act provides for nationally important archaeological sites to be statutorily protected as Scheduled Monuments (SMs). Scheduled Monument Consent (SMC) must be sought for any works which may affect a designated Scheduled Monument. SMC is not required for works affecting the setting of a Scheduled Monument.
- 2.3.2 The principal national guidance on the importance, management and safeguarding of the archaeological resource within the planning process is contained in *Planning Policy Guidance Note 16: Archaeology and Planning* (PPG 16) issued by the Department of the Environment in November 1990. The underlying principle of this guidance is that archaeological resources are non-renewable, stating that:

*...Where nationally important archaeological remains, whether scheduled or not, and their settings are affected by proposed development there should be a presumption in favour of their physical preservation. (Para. 8)*

Paragraph 19 states:

*In their own interests...prospective developers should in all cases include as part of their research into the development of a site...an initial assessment of whether the site is known or likely to contain archaeological remains.*

Paragraph 22 adds:

*Local Planning Authorities can expect developers to provide the results of such assessments ...as part of their application for sites where there is good reason to believe there are remains of archaeological importance.*

Following on from the statement in paragraph 8 regarding the case for preservation *in situ* of nationally important archaeological remains, paragraph 27 advises:

*... The case for the preservation of archaeological remains must however be assessed on the individual merits of each case, taking into account the archaeological policies in detailed development plans, together with all other relevant policies and material considerations, including the intrinsic importance of the remains and weighing these against the need for the proposed development.*

### **Regional and Local Planning Guidance**

- 2.3.3 Major changes are currently being introduced to the planning system across the UK. One of the effects of this change is the replacement and consolidation of local and structure plans into a Local Development Framework (LDF) and Regional Spatial Strategies (RSS) respectively.

#### Structure Plan

- 2.3.4 The *Devon Structure Plan 2001-2016*, adopted October 2004 is the current plan for development control purposes and will remain in force until the revised RSS replaces it; it is understood that this will be from October 2007.
- 2.3.5 The Structure Plan recognises that archaeological sites and monuments and their settings are a finite and non-renewable resource and that the historic built heritage is a significant environmental, cultural and educational resource. Policy CO8 – Archaeology states:

*Internationally, nationally and regionally important archaeological sites and their settings, whether Scheduled Monuments or unscheduled, will be preserved. Other important sites and their settings should be preserved wherever possible, and in considering proposals for development which would have an adverse impact on them, the importance and value of the remains will be a determining factor. Where a lack of information precludes the proper assessment of a site or area with archaeological potential, developers will be required to arrange appropriate prior evaluation in advance of any decision to affect the site or area. Where the loss of an archaeological site or area is acceptable, proper provision for archaeological excavation and recording will be required.*

#### Local Plan

- 2.3.6 The *City of Plymouth Local Plan* (adopted 1996) is the current plan for development control purposes and will remain in force until the revised LDF replaces it in 2007. However, parts of the Local Plan have already started to

be replaced by the Plymouth LDF and the emerging LDF document is a material consideration in dealing with planning matters.

- 2.3.7 The Plymouth Local Plan (adopted 1996) sets out detailed policies and specifications for development and land-use. It derives its policy directly from the Structure Plan (see above). Chapter 3 (Environment) of the Local Plan contains policies relevant to the Historic Environment; these are rehearsed below.

Policy AEV11 - Archaeology states:

*The city's archaeological and historic heritage will be preserved as far as practicable. In particular:*

- *An archaeological assessment and/or field evaluation report should, when appropriate, be submitted as part of a planning application for the development proposals that are likely to affect a site of archaeological interest or importance.*
- *Planning permission for developments which would destroy or seriously damage nationally important remains, whether scheduled or un-scheduled, or their character or setting, will be refused. Special regard will be had to the preservation of sites of local archaeological and historic importance where such remains would be unacceptably affected by development proposals.*
- *Development schemes should preserve archaeological remains on site where appropriate and feasible.*
- *Conditions on planning permissions will be imposed and/or agreements will be sought with developers to ensure that, where appropriate, sites of archaeological interest including standing structures are excavated and/or recorded to the council's satisfaction, before alteration, demolition, site clearance or development commences; or are subject to a limited recording action project during development, and that the results of any recording project or excavation are made available to the public.*

Policy AEV13 – Character and Setting of Ancient Monuments states:

*Development proposals and works which harm the character and setting of ancient monuments will not be permitted.*

- 2.3.8 The Plymouth LDF is an emerging planning document and as such, the proposed policy and directions for the document are being set out through a series of Preferred Option Reports. As yet, there are no specific policies outlined for the historic environment in the Cattedown area beyond the generic City-wide statements in the Core Strategy. However, a draft of the submission for the East End Area Action Plan, which will include the area of Cattedown, identifies the vision for the area as '*...to create a sustainable mixed-use urban district that respects its heritage and is well connected to the waterfront*'. This will be delivered through a number of objectives, including *Objective 7: To conserve and enhance the area's natural and built historic environment assets.*

### **3 HISTORIC ENVIRONMENT BASELINE**

#### **3.1 Legislative and Planning Constraints**

##### ***Scheduled Monuments***

- 3.1.1 There is one Scheduled Monument within the vicinity the Site. Located on the western side of the limestone bluff which supports Higher Cattedown Road, Worth's Cattedown Bone Cave is situated approximately 70m from the western boundary of the Site (**Figure 1**).
- 3.1.2 The monument comprises a cave of two similar sized chambers joined by a *narrow fissure running north-south along the natural jointing of the rock*. This part of the cave system was opened up by quarrying activity in the late 19<sup>th</sup> century. Archaeological investigations which involved the partial excavation of the main chambers recorded extensive human and faunal remains, which date to the Middle to Late Upper Palaeolithic.
- 3.1.3 Some of the earliest evidence of human activity during the Palaeolithic period in this country comes from deposits contained within caves, rock shelters and fissures in the areas of the country with cave bearing geology. These sites are therefore of major importance for understanding this period. In the scheduling document English Heritage states that '*...due to their [i.e. caves] comparative rarity, their considerable age and their longevity as a monument type, all examples with good survival of deposits are considered to be nationally important*'.
- 3.1.4 The proposed development would not have any direct impacts on the fabric of the Scheduled Monument within the Scheduled area and would not require Scheduled Monument Consent.

##### ***Other designations***

- 3.1.5 There are no other statutorily or locally designated sites within the Study Area.

#### **3.2 Geology and landscape development**

- 3.2.1 Cattedown is a peninsula projecting into the Cattewater at the mouth of the River Plym and the upper (north-eastern) reaches of Plymouth Sound. The underlying geology of the promontory and the northern and southern coast of the Cattewater is Middle Devonian Limestone.
- 3.2.2 The Cattewater is a ria – a flooded glacial valley – lying between the promontories of Cattedown on the north shore and Mount Batten and Oreston on the south shore, at the upper reaches of Plymouth Sound. Up until approximately 10,000 years ago, sea level was considerably lower than it is today. The River Plym would have been situated in a deep, limestone cliff sided gorge with its bed approximately 24m lower than the modern level, the modern coastline having been created by the rising sea-level which flooded the valley of the Plym. Up until this period the Cattedown Peninsula occupied a relatively elevated and inland position. The Devonian limestone 'massive', which bounds both shores of the modern Cattewater, would have existed intact and contained innumerable caves and fissures within the rock.

- 3.2.3 The name Cattedown (Cat Down) refers to the upland pastures typical of karst limestone landscapes. To the north of the Site the area of 'Shapter's Field' refers to part of this pasture landscape which would have overlooked the Cattewater and provided grazing for stock, prior to the largescale removal of much of the limestone by quarrying.
- 3.2.4 The landscape of Cattedown has been dramatically altered by the intensive and extensive quarrying of the limestone resource. Quarrying began in this area in the 17<sup>th</sup> century but saw its most intensive commercial period during the 19<sup>th</sup> century.
- 3.2.5 The Site is located on the western boundary of the area known as Cattedown Quarry, which was active during the 19<sup>th</sup> century and also known as Prince Rock Quarry. Ordnance Survey maps dated 1894, 1907, 1914 and 1933 indicate the progress of the quarry face (See **Figure 2**). Quarrying finished at the site shortly before the Second World War. The edge of the quarry is marked by a narrow limestone upstand left between two quarries, which supports Cattedown Road and through which the railway passes in tunnel.
- 3.2.6 After the closure of the quarries Cattedown, an area located away from centres of population and with good access to the waterfront and the railway, became the site of noxious industries including gas works, fuel depots and chemical factories. Within the Site there was an abattoir, hide factory and meat market, which was constructed during the 1930s.
- 3.2.7 The modern landscape of Cattedown is a mixture of 19<sup>th</sup> and 20<sup>th</sup> century large-scale industrial buildings built within the areas of the old quarries. A number of small vestigial limestone cliffs represent the pre-quarrying ground level, and the original karst limestone landscape.

### **3.3 Previous archaeological work**

- 3.3.1 A number of archaeological investigations have been undertaken within the area of Cattedown, mainly focused on waterside developments (Wessex Archaeology 2000a, 2000b, 2000d, 2000e). Closer to the Site previous archaeological investigations were undertaken by Wessex Archaeology in the Cattedown area in advance of a major land reclamation scheme in the early 1990s. The investigations entailed a Desk-based Assessment of the area; a Cave Survey of the fissures within Shapter's Field; limited archaeological trial trenching within Shapter's Field; and an Auger Survey on Cockle Bank on the shores of the Cattewater (to the south of the Site).
- 3.3.2 The survey concluded that there was a high potential for the continuation of existing adjacent mapped cave systems to extend into the upstanding limestone bluff if present, such caves would have a high potential to contain hominid and fossil faunal remains of national significance.
- 3.3.3 The results of any subsequent archaeological work in advance of the development were not available for consultation. The remainder of the limestone bluff at Shapter's Field has since been quarried away and now contains industrial units.

### 3.4 General archaeological background

- 3.4.1 Within the wider area around the Cattewater archaeological remains indicative of human activity, dating from the Palaeolithic to the Roman period and later, have been recorded.
- 3.4.2 Evidence for very early prehistoric human activity in the area was first recognised in the 19<sup>th</sup> century, with the recovery of human and faunal remains from cave deposits within the natural fissures and caves that form an integral part of the limestone massive of Cattedown. The significance and extent of this archaeological resource is discussed fully below (**Section 3.5**).
- 3.4.3 The established archaeological and geo-morphological record indicates that, from the Mesolithic period (8000BC) onwards, populations in this area would have utilised the rapidly changing coastal and estuarine landscape, as sea-levels rose and the valley of the Plym became flooded to form the basis of the modern coastline.
- 3.4.4 By the later prehistoric period evidence from the wider area suggests, as with much of the rest of Britain, a population more stable and sedentary in their subsistence, with the building of monuments and the establishment of trade routes. This development continued throughout the Iron Age and into the Romano-British period and is, perhaps, best highlighted in this coastal area by the siting of a Romano-British trading station on the southern shore of the Cattewater on the Mount Batten headland.
- 3.4.5 Later development of the coastal trade infrastructure took place as the city of Plymouth developed from the 14<sup>th</sup> century onwards, becoming one of the most important ports on the southern British coast.
- 3.4.6 A more detailed rehearsal of the archaeological and historical development within the Cattedown area is contained in *Cattedown Reclamation Scheme, Plymouth, Archaeological Evaluation Volumes 1 and 2* (Wessex Archaeology 1993).

### 3.5 Cave formation and cave deposits

- 3.5.1 The cave systems that form within limestone geologies comprise chambers and fissures, the size and morphology of which is determined by the specific hydrological and geological conditions of the area.
- 3.5.2 The landscape and topography of caves is complex. The processes by which deposits containing archaeological remains enter cave systems can be equally difficult to interpret, especially as the environment within a cave system can be periodically one of high energy, resulting in admixture and reorganisation of stratified deposits long after they were originally deposited.
- 3.5.3 In order to gain an understanding of the potential resource contained within the Site, it is important to understand the formation and the landscape of the cave system within the Cattedown peninsula, i) as it would have been prior to the removal of the vast majority of the limestone bluff by quarrying; and ii) during the archaeological period during which human activity may have occurred within the caves.
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- 3.5.4 Within karst geology caves form by the passage of water draining through the limestone rock from the surface, dissolving the limestone rock as it passes through. The formation of caves in this way, beneath the water table, is termed 'phreatic' cave formation. This phreatic activity is concentrated along natural weaknesses in the limestone, which take the form of vertical or horizontal cracks known respectively as joints or bedding planes, and it is the enlargement of these that create cave chambers and fissures.
- 3.5.5 The phreatic solution activity in the Cattedown area may also have been enhanced by the mixture of saline and freshwater which, with the variations in sea level during the Pleistocene, could have assisted cave formation up to 30m aOD (Chamberlain and Ray 1994, 5).
- 3.5.6 Prior to the removal of the limestone bluff by quarrying, the subterranean cave system would have been accessed by humans, animals and draining surface water through openings in the ground and the coastal cliff face.
- 3.5.7 The caves and fissures lower down in the system would have acted as repositories for deposits. The excavated archaeological remains from the caves in the Cattedown area suggest that these were not primary activity sites; instead the deposits are more likely to be derived from human and animal activity that would have taken place in or around caves and chambers higher up within the cave system. These deposits have been washed down through the cave system with the continuing drainage of water permeating through the limestone rock.

### **3.6 Cave deposits – an early prehistoric archaeological resource**

- 3.6.1 Within the Plymouth Region (from Mount Wise in the west to Yealmbridge in the east) there are 40 recorded cave sites that contain, or are highly likely to contain, fossil-bearing Quaternary deposits (**Figure 1** inset). Of these 40 sites, five are known to have contained human remains and diagnostic flint tools of possible Upper Palaeolithic date (40,000 – 10,000 years ago) (Chamberlain and Ray 1994, 1).
- 3.6.2 The fossil fauna species recorded in cave sites in this region include assemblages associated with the environment of the later stages of the Ipswichian Interglacial period (131,000 -100,000 years ago), a time of warmer temperatures when large mammals such as lion, rhinoceros, hippo and elephant would have been present on the British peninsula.
- 3.6.3 However, the cave deposits also contain faunal assemblages indicative of the subsequent and final glacial period, the Devensian. This period lasted from 70,000 to 10,000 years ago and it is from the later stages of the Devensian that intermittent traces of activity of anatomically modern man have been recorded in cave sites and open sites in southern Britain (Allen and Gardiner 2006, 19; Evans 1975).
- 3.6.4 The Upper Palaeolithic refers to the earliest period of anatomically modern human activity on the British peninsula and, in general terms, remains of human activity of this date are comparatively rare across Britain and northern Europe. A contributing factor to this rarity is not only the small numbers and transient subsistence patterns of hominid populations,

resulting in a very restricted 'archaeological signature', but also the poor survival of archaeological remains from this period. Although a number of Upper Palaeolithic 'open sites' have been excavated from in Britain (Barton 1997 *et al*), the majority of the information relating to human activity at this time comes from deposits within caves. This differential preservation is not necessarily representative of a predilection for human utilisation of caves over other sites, but more the product of the good conditions offered by the cave environment for the survival of the deposits within it.

3.6.5 During the Upper Palaeolithic sea level was much lower than its modern height, with a dry land bridge where the English Channel now separates Britain from mainland Europe. Rapid climatic change during this period saw the environment oscillate between arctic and sub arctic conditions. Populations are thought to have migrated onto the British peninsula during the milder episodes (interstadials), retreating during the colder glacial phases. The earliest evidence for human activity within what is now the British Isles dates to approximately 40,000 years ago (Early Upper Palaeolithic). Human activity during this period appears to have been intermittent, and it is thought that during the coldest part of the last cold stage (between 25,000 and 18,000 years ago), there was a prolonged absence of humans in much of northern Europe, including Britain. The Late Glacial Period (after 18,000- 10,000 years ago) is characterised by a dramatic warming, with temperatures peaking shortly after c.13,000 years ago.

3.6.6 The exact mechanism by which Britain and the rest of northern Europe were 'recolonised' after the last cold glacial period is the subject of academic debate. However, there are a number of sites across southern Britain which date to this Late Upper Palaeolithic period, such as Gough's Cave in Somerset. The human occupation and activity in and around this site has a radio-carbon date of 16,000 years ago, and is one of the earliest known 'reoccupation' sites that has been accurately dated in the country (Jacobi 2004 *et. al.*).

### 3.7 **Worth's Cattedown Bone Cave**

3.7.1 Worth's Cattedown Bone Cave is situated on the opposite side of the limestone upstand which forms the western boundary of the site, a distance from the Site of approximately 70m in a straight line. In the 19<sup>th</sup> century, following its discovery in the face of the quarry the cave was excavated by a local archaeologist, R.M Worth. His excavation recorded a pair of chambers connected by a fissure. Among the faunal remains recovered from the cavern were human teeth from the lower cave earth stratum and the bones of fifteen individuals from the uppermost cave breccia deposits.

3.7.2 The remains of at least 15 individual hominids of both sexes, including children and adults, were recovered from both of the main levels of cave deposits. The 33 species present in the fossil faunal assemblages range in date from the Middle Palaeolithic to Upper Palaeolithic/Ipswichian-Devensian (c. 128,000 – 10,000 years ago).

3.7.3 Recent reanalysis of the original 19<sup>th</sup> century excavations has concluded that the provenance of the deposits excavated from, and still preserved

within, the cave is probably the result of a collapse in the floor of a cave higher up in the system. This resulted in the infiltration of human and faunal remains deep into the more inaccessible reaches of the cave system, from what was probably a fairly accessible cave above, closer to the contemporary land surface (Devon Karst Research Society 2006).

3.7.4 Unfortunately, a combination of the taphonomic complexities of cave sites, the techniques used by the 19<sup>th</sup> century excavators and the loss of much of the excavated archive during the Second World War has led to uncertainty as to the association of the broadly datable faunal remains with the human remains. However, it is possible that Worth's Cattedown Bone Cave could contain some of the earliest remains of anatomically modern humans (*Homo sapiens sapiens*) in the country, which would date to the Early Upper Palaeolithic (40,000 to 25,000 years ago). However, it is also possible that the human remains are from the Later Upper Palaeolithic (18,000 to 10,000 years ago), which is in itself a very important period, representing the reoccupation of what is now Britain after a period of human absence from areas this far north during the last glacial maximum (25,000 to 18000 years ago).

3.7.5 It is therefore possible that the human remains recorded within the chambers of Worth's Cattedown Bone Cave could relate to activity that took place immediately before or after the last glacial maximum. Either scenario equates to an archaeological resource that is of great significance and national importance.

3.7.6 The original excavations in the 19<sup>th</sup> century did not remove all the cave deposits from the chambers and adjoining parallel and lateral fissures, and cave deposits are thought to continue beyond 8m in depth below the level of the quarry floor. It is certain that further deposits exist within this area. The importance of protecting these *in situ* remains is recognised in the English Heritage scheduling document for the cave site. The Devon Karst Research Society is developing a strategy for a Cattedown Bone Caves Heritage Site (<http://www.devonkarst.org.uk>) for the protection of the contextual karst environment and its bone cave, surrounding the core Palaeolithic Cave site.

### **3.8 Known and potential archaeology within the Site**

3.8.1 The Site is located entirely within an a former quarry and it is certain that no deposits with potential to contain any archaeological remains dating from the Mesolithic to the modern period are present within the bounds of the Site.

3.8.2 However, it is highly likely that the karst limestone geology beneath the former quarry floor within the Site, as with elsewhere at a similar depth on the Cattedown peninsula, contains fissures, or solution features. Results from a drilling investigation within the Site (John Grimes Partnership 2000, p3) indicate that 'minor solutioning' was encountered in the three exploratory boreholes at approximately 15m depth (-9m aOD); these solution features comprised clay filled voids less than 300mm deep (*ibid*).

3.8.3 The significance of any potential remains of archaeological value within fissures, where present within the Site, is directly informed by the nature and extent of remains within the adjacent Scheduled Monument of Worth's

Cattedown Bone Cave. It is reasonable to assume, given an assessment of the nature of the karst geology of the area, and the information from the drilling investigation, that fissures (solution features) similar to those exposed within the limestone upstand on the western boundary of the Site and at Worth's Cattedown Bone Cave could be present beneath the Site.

- 3.8.4 It is also reasonable to assume that, if present, fissures and/or chambers may contain sedimentary deposits that could feasibly contain archaeological remains similar to those recorded in Worth's Cattedown Bone Cave and elsewhere on the Cattedown peninsula.
- 3.8.5 If this is the case, it is possible that the Site has the potential to contain archaeological remains of **national significance**.

### **Existing Impacts**

- 3.8.6 The reduction in ground level by quarrying within the Site has resulted in the complete removal of any archaeological remains that may have been present within the topsoil, subsoil or cut into the top of the bedrock at the pre-quarry ground level.
- 3.8.7 After the closure of the quarry, the Site was developed as an abattoir, hide factory and meat market. This comprised late 20<sup>th</sup> century low-grade industrial buildings with areas of tanks and drainage constructed from prefabricated buildings on concrete slab. Geotechnical investigations indicate made ground of approximately 3-4m thickness across the Site. Therefore, the foundations for the abattoir buildings are unlikely to have penetrated into the bedrock and the previous impact of building construction on potential fissures in the limestone is likely to be negligible.
- 3.8.8 The geotechnical report states that a trial pit investigation carried out previously to assess levels of contamination on the Site indicated the presence of heavy metals such as arsenic, selenium, nickel and zinc in the ground, all in quantities exceeding safe levels for parks and playing fields.
- 3.8.9 All the boreholes for the geotechnical survey appear to have encountered water at the interface between the limestone and the made ground. An immiscible oily and fatty film was present on the surface of this water. The film had a distinct hydrocarbon odour and the presence of a strong 'cattle' smell was also noted (John Grimes 2000, 6). It is likely that these possible contaminants derive from storage of fuel for the abattoir and the organic and chemical by-products of the abattoir processes, and have contributed to the contamination of the groundwater on the Site.
- 3.8.10 It is possible that these organic and chemical contaminants may have leached into the bedrock beneath the Site. Contact of these substances with human and faunal remains may have compromised their scientific validity in terms of their suitability for radio-carbon dating.

### **3.9 Potential Impacts**

- 3.9.1 The potential impacts of the construction and operation of the Site, which could result in effects on the archaeological resource, are:

- Excavation, ground disturbance and compaction; and
  - Construction of main foundation scheme by pile driving.
- 3.9.2 These impacts could lead to the following effects on the Historic Environment resource:
- Partial/Complete loss of archaeological remains contained in potential fissures within the impact zone of each pile;
  - Alteration to the hydrology of the Site due to potential 'capillary' action of pile foundations resulting in increase in leaching of potential contaminants into the bedrock potentially compromising scientific validity of archaeological deposits; and
  - Permanent covering of buried resources.
- 3.9.3 The direct physical impacts of the proposed development would be limited to the pile driving for the foundation scheme. The design proposals indicate a number of tanks will be excavated for the plant process. However, these excavations would be contained within the level of the made ground on the Site and would not penetrate the bedrock.
- 3.9.4 It is possible that during the pile driving for foundations, chemical and organic contaminants present within the ground water on the Site could be introduced into the bedrock, potentially contaminating the deposits within any fissures present. It is possible that, if present, the viability of the deposits for scientific dating purposes could be compromised. A similar impact could arise from any 'capillary' action introduced by the pile foundations.
- 3.9.5 Additional adverse impacts arising from the construction and operation of the scheme were considered as part of the research but discounted after consultation with the client.
- 3.9.6 The possibility of an adverse impact the stability of the limestone upstand to the west of the Site, which contains the Scheduled Monument of Worth's Cattedown Bone Cave, resulting from the vibrations generated through pile driving are thought not to be significant enough to penetrate the bedrock outside the bounds of the Site.
- 3.9.7 Also the possibility that airborne particulates emanating from the plant during operation may have the potential to contaminate deposits located in exposed fissures within the limestone bluff to the west of the Site was also considered. However all cements and fine materials are brought to the site in sealed tankers and pumped into sealed silos to prevent any fine material escaping. The proposed plant would operate to strict environmental legislation and therefore there is not considered to be a risk to exposed fissures from contamination by airborne particulates.
- 3.9.8 The areas surrounding the central batching plant would form hard standing for car parking and manoeuvring of trucks around the plant, with a limited area of shrub and tree planting on the eastern edge of the Site to screen it from Shapter's Way. These elements of the proposed development would have no direct impact on the potential archaeological resource within the Site.

## **4 CONCLUSIONS AND RECOMMENDATIONS**

### **4.1 Summary**

- 4.1.1 An assessment of the geological and archaeological resource within the surrounding area indicates that it is reasonable to assume that natural fissures, or solution features, may be present within the bounds of the Site. Where present, it is also reasonable to assume that these natural features may contain faunal remains of the Devensian Glacial and human remains, or indications of human activity, dating to the Upper Palaeolithic period.
- 4.1.2 The significance of such remains is highlighted by the Scheduled Monument of Worth's Cattedown Bone Cave, situated approximately 70m to the west of the Site. The resource recorded and preserved within this cave site and its adjacent lateral fissures is of national importance: any similar remains present within the Site should also be regarded as of national importance.
- 4.1.3 The proposed development would comprise plant buildings constructed on concrete slabs supported by driven pile foundations. If present, there would be direct adverse impacts on potential archaeological remains resulting from the sinking of the piles. The pile foundations could also have indirect adverse effects on the preservation and survival of remains within the Site, due to the potential for changes in the water table and drainage regime resulting from the 'capillary' action of the pile foundations.
- 4.1.4 A revised foundation scheme which removes the need for, or reduces the number of, driven piles required for the construction of the proposed plant could remove or reduce the adverse impact of the proposed foundation scheme.

### **4.2 Recommendations**

- 4.2.1 The presence and location of fissures, or solution features, within the bounds of the Site is fundamental to understanding the archaeological resource that is likely to be affected by the proposed development.
- 4.2.2 The presence and extent of these natural features cannot be determined using 'desk-based' techniques. Therefore, further archaeological investigation of the Site will be necessary in order to try and establish the location of any such fissures in the bedrock.
- 4.2.3 Consultation with the Historic Environment Officer for Plymouth County Council concluded that, due to the depth of made ground across the Site and the potential for the contamination of groundwater with heavy metals and hydrocarbons, archaeological evaluation by trial excavation would not provide a safe or effective way of prospecting for these natural features.
- 4.2.4 A staged programme of archaeological evaluation is recommended. In the first instance, this may entail the use of remote sensing techniques, such as geophysical survey, to establish the presence and location of any fissures within bedrock beneath the Site, subject to suitable ground conditions.
- 4.2.5 The results of this further stage of archaeological survey would directly inform the need for and scope of any further investigation and/or mitigation
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that may be possible, to reduce the potential impact of the proposed development of the archaeological resource. Such further investigation might entail the use of geoarchaeological boreholes to confirm the presence of deposits of potential archaeological interest, where these could be affected by the proposed development.

- 4.2.6 Consultation with the design engineer could provide an alternative foundation scheme, which would reduce or remove the potential adverse impact of Site construction.

#### **4.3 Further work**

- 4.3.1 In order to ensure the correct and most effective geophysical survey technique is used, it is recommended that the Site be reconnoitred by a Geophysicist. However, in the first instance it is suggested that Electrical Resistivity Tomography (ERT) or low-frequency ground penetrating radar (GPR) may be a suitable technique for a Site of this size and on this geology.
- 4.3.2 Any further archaeological investigation at the Site should be undertaken in line with a detailed project design or written scheme of investigation (WSI), to be submitted for approval by the Historic Environment Officer for Plymouth City Council prior to any work commencing.

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### Internet Resources

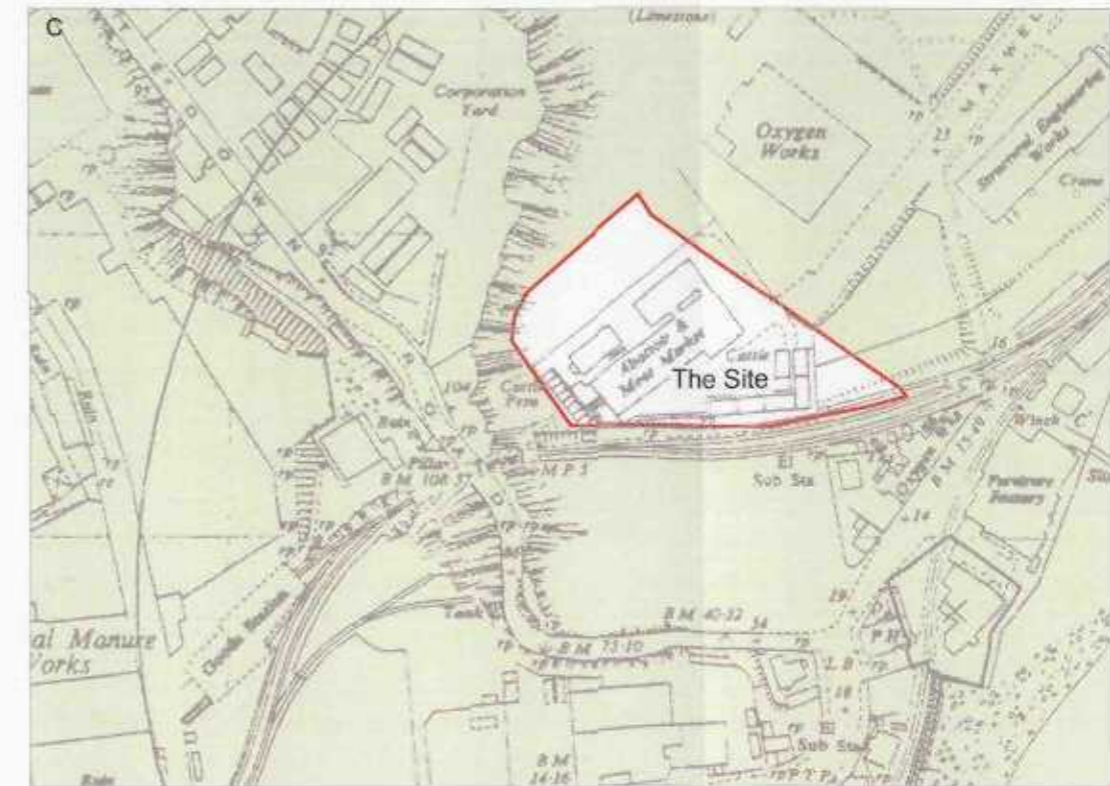
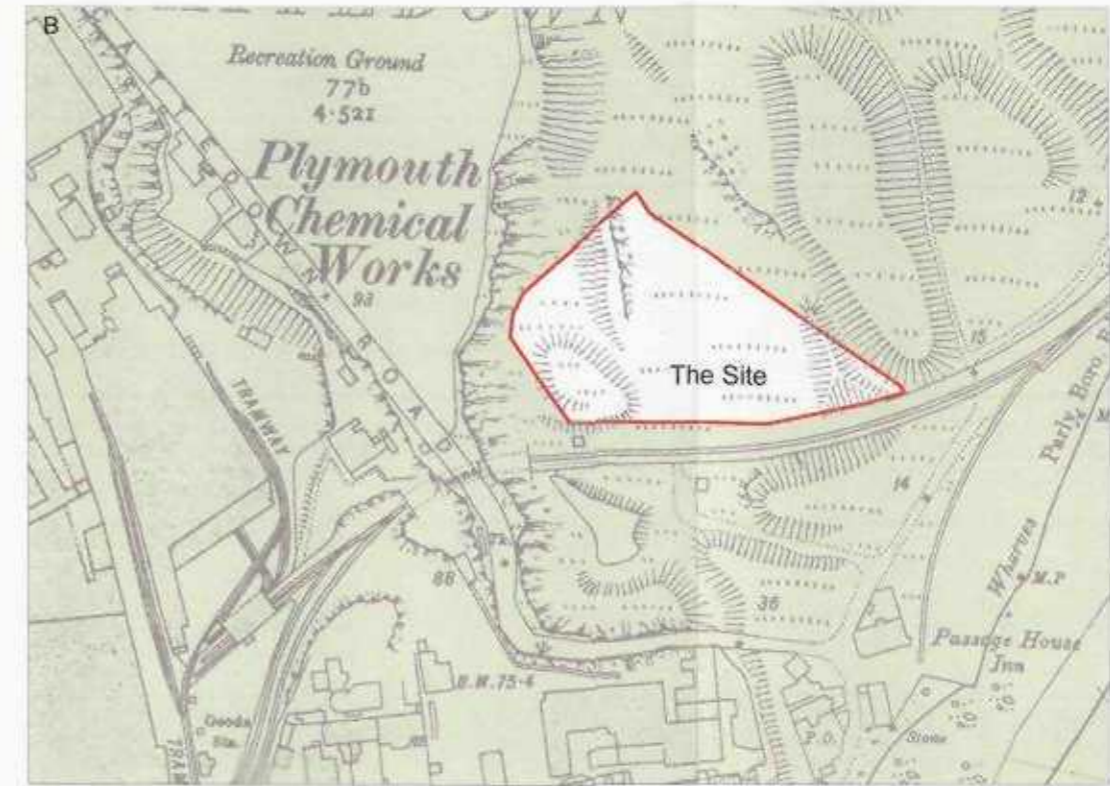
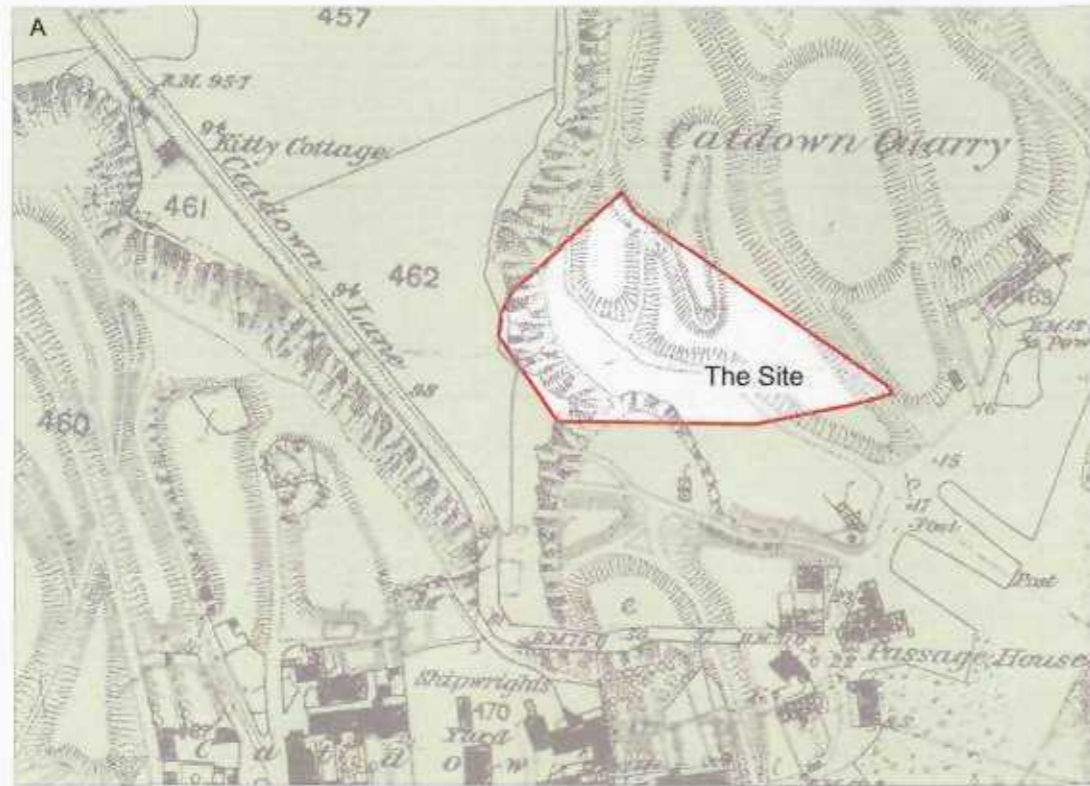
<http://www.devonkarst.org.uk> The Devon Karst Research Society website, assessed October/November 2006

<http://www.capra.group.shef.ac.uk/> Cave Archaeology and Palaeontology Research Archive October/November 2006



Site location

Figure 1



- A - 1879 OS map , 1:2500
- B - 1914 OS map , 1:2500
- C - 1953 OS map , 1:2500



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Plate 1: Viewed from Shapter's Way looking south-west



Plate 2: North-west corner of site



Plate 3: View from middle of site looking north



Plate 4: View of southern end of site