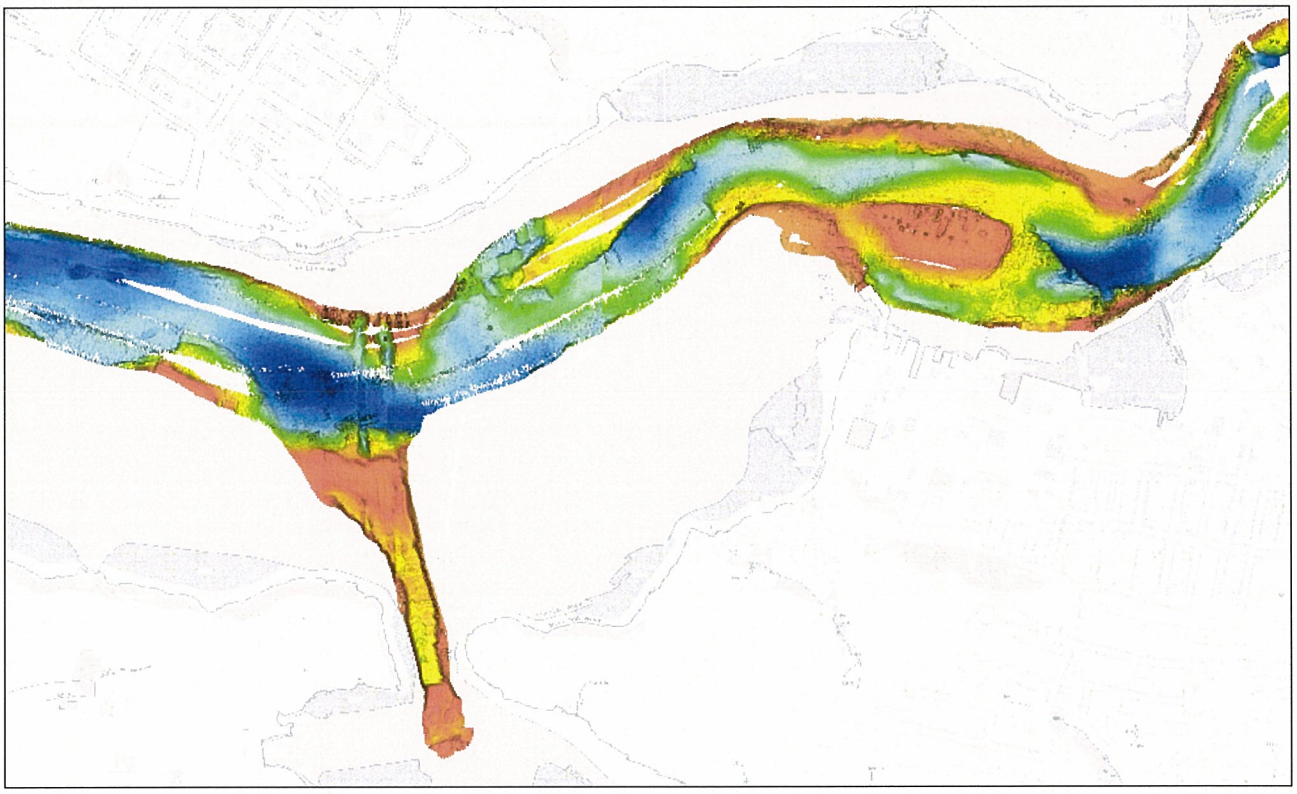
MILFORD HAVEN WATERWAY PORTS & HARBOURS PROJECT



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MILFORD HAVEN WATERWAY PORTS & HARBOURS PROJECT

Gan / By

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SUMMARY

This study has been undertaken as part of the Cadw funded pan Wales Ports and Harbours Project. Its purpose is to identify the maritime archaeological resource including the archaeological potential of Milford Haven Waterway. Through documentary research an understanding has been developed of the known maritime archaeological resource. This has been effectively mapped and catalogued through the use of Map Info GIS and the creation and integration of records with the Regional Historic Environment Record.

The project has also established links with a variety of stakeholders including the Milford Haven Port Authority, Pembrokeshire Coast National Park Authority, Pembrokeshire County Council, Countryside Council for Wales, Environment Agency Wales and numerous local and special interest groups who hold information on and can actively influence/manage the historic environment resource.

An understanding of the known and potential surviving maritime archaeological resource has been described and future threats to that resource have been outlined. The results of the study have been presented in such a way as to enable their effective use by strategic decision makers and forward planners to ensure that this finite and non-renewable resource is appropriately considered, and due consideration given to opportunities that it may present.

INTRODUCTION

The Milford Haven Waterway – Ports and Harbours Project was developed in response to the pressing need to more fully appreciate the maritime archaeological potential of the Haven, especially given the increasing industrialisation and traffic along the waterway and its potential impact on the archaeological resource. The project seeks to develop our understanding of the waterway's maritime heritage through a desk-top assessment of available historic map and chart sources, and to integrate this within the regional Historic Environment Record (HER). New information has also been retrieved from a variety of sources which together have been recorded and mapped using modern GIS techniques, thus creating a fuller and more rounded account of the waterway and its archaeological potential. With a better understanding of the threats to the archaeological resource recommendations can now be made for the future protection of this resource. This information can then be disseminated in a useable format to, and links established with, key stakeholders within the Haven area who hold information on and can actively influence and manage the resource.

Maritime Archaeology Definition

A definition of maritime archaeology in the context of this study is the physical remains of activity associated with the Milford Haven Waterway, either directly as surviving remains beneath and at the edges of the water and in the intertidal zone (e.g. submerged landscapes, wrecks and quays) or indirectly due to the presence of the waterway (e.g. settlement and military forts). Therefore other types of features or sites which are not associated with the waterway, but which happen to be closely situated, are not necessarily included.

Project Aims

The main purpose of this project is to provide, in a useable GIS format, an up to date understanding of the maritime archaeology of the Milford Haven Waterway and indicate areas of further maritime archaeological potential. These results are intended to be used by decision makers and other interested parties to ensure the future appreciation and appropriate management of this unique and valuable resource.

The intended users range from specialist maritime archaeologist through to strategic decision makers such as Milford Haven Port Authority, Local Planning Authorities, the Countryside Council for Wales and the Environment Agency. The results of this study are therefore presented at a number of levels of detail aimed at addressing the various needs of the study's audience. For example, the detailed records of individual archaeological sites and deposits have been integrated into the Regional Historic Environment Record, a public record the core aspects of which are soon to be available on the internet, while mapping of areas of known and potential archaeology will indicate where there are potential conflicts of land-use change with maritime archaeology.

It is increasingly recognized and acknowledged (e.g. WAG Environment Strategy, etc.) the importance of Wales' historic environment to the character of its landscape and to its communities, the fundamental part that it plays in creating a sense of place, local identity and sense of community as well as being an important economic resource in relation to tourism. These surviving physical remains are a finite, fragile and non-renewable resource that provide us with a unique opportunity to understand our past.

The survival of such remains can easily be threatened. Without adequate understanding proper consideration cannot be given to the importance of what

might be lost. This study will therefore help to prevent the loss of aspects of the Haven's maritime heritage for want of an adequate understanding

In recent times there has been an increasing rate of change within the Milford Haven area driven by the importance of the deep water harbour to the energy industry and the importation of Liquid Natural Gas. Tourism continues to grow and the services and infrastructure needed to support this industry also grows. Development and associated activity with the potential to impact on the historic environment, has increased. Up until now it has only been possible to respond to these potential impacts on a re-active, case by case, basis. In particular little has been known or appreciated of the potential importance of the below water archaeological resource.

This study allows forward planners to appreciate the potential implications of development on the historic environment in a pro-active context, enabling opportunities as well as constraints to be recognised early on in the project planning process.

Archaeological Objectives

This project has also been developed in order to address a number of the issues raised in *Maritime and Intertidal Archaeology*, Sian E. Rees, 2003 in "A Research Framework for the Archaeology of Wales". These include:-

- Identifying areas of the coastline and types of deposits of high potential in the marine historic environment
- Identifying threats to the conservation of intertidal and maritime sites such as erosion, development, dredging and mineral exploitation and identifying appropriate response mechanisms
- Encouraging primary fieldwork, both amateur and professional, especially in potentially rewarding areas, and as a fast response after storm damage
- Encouraging partnership within appropriate large scale projects, either research based or development projects
- Selecting for scheduling or designation sites of national importance within the intertidal and maritime zones; encouraging appropriate local authorities and conservation bodies to designate other non-statutory zones of importance

The project aims to build on the 1997-8 Coastal Survey (Murphy and Allen 1998) and the Milford Haven Historic Audit conducted between 1999 and 2003 (Austin *et al* 2003; Hall *et al* 1999, 2000), which principally identified archaeological sites from historic map sources and a rapid walk-over survey. However these did not address or map the full extent of the major ports and quays along the Haven, nor assess the extent of any associated archaeological potential.

The first part of the *Register of Landscapes of Historic Interest in Wales* published in 1998 recognised the Milford Haven Waterway as one of 36 'outstanding' historic landscapes in Wales (Cadw, *et al* 1998). The subsequent and more detailed historic landscape characterisation of the registered landscape of the Haven was undertaken in 2001, during which 48 separate character areas were identified, described and photographed, with an overview of each area's historical development outlined within the overall context of the waterway (Murphy and Ludlow 2002). These character areas reflected the diverse nature of the waterway's historic landscape, and included the medieval towns of Pembroke and Haverfordwest, the late 18th and early 19th century planned towns and docks of Milford Haven and Pembroke Dock, the late 20th century industrial installations such as oil refineries, the villages surrounded by the enclosed remnants of their open-field systems, dispersed farms, villages and hamlets, ports and quays, mansion

houses with parks and gardens, and the 19th and 20th century military forts and gun emplacements (*ibid.*:1).

However, so far no assessment of the archaeological potential of the actual waterway itself has ever been undertaken: although Admiralty Charts and the National Monument Record (NMR) records numerous vessels having been lost within the Haven. The presence or absence of any wreckage has not been ascertained. There have only been limited geoarchaeological investigations conducted within the Haven (see Bates, *et al* 2004), and although various submerged topographical and seabed characterisation datasets exist (e.g. swathe bathymetry and side-scan sonar, see Maloney and Vail 2002), none of these have been analysed or interpreted specifically with the aim of retrieving any potential archaeological information. However, even within the relatively small survey area investigated by Topaz Environment and Marine (TEAM) in 2004, they concluded that there was the potential for undisturbed Upper Palaeolithic and Mesolithic deposits within the sub-bottom horizons, as well as excellent palaeo-environmental potential indicating long records of environmental change preserved within the sediments of the Haven (Bates, *et al* 2004: 6.1). In terms of sea bed surface archaeological deposits, not only were there wreck sites and debris from WWII activity indicated by the magnetic and sidescan data collected by TEAM, but also some additional targets which were suggested as possible Bluestone locations (*ibid.*: 6.2).[1]

It is hoped that the Milford Haven Waterway – Ports and Harbours project will inspire future investigative archaeological works in the Haven, particularly in tandem with diving clubs and local community groups, as well as lead to a closer working relationship with the Milford Haven Port Authority (MHPA) in mitigating against potential impacts on the known and perceived archaeological resource of the waterway.

Methodology

The production of this report has developed as a unique project but has utilized best practice elsewhere and in part has drawn from similar maritime surveys around the coast of Wales. The study has included the following work:-

HER enhancement

The project comprises a review of existing information about the archaeological resource. Information recorded on the Historic Environment Record was assessed and combined into a single project database. The HER enhancement then involved validating, updating, and where required creating new HER records, related specifically to the use, or suspected use, of the Milford Haven Waterway. Where spatial data is available digital mapping of sites has been undertaken, see Appendix 1; Mapinfo Tables – 'A:HER sites'. Rapid site visits were also undertaken in some instances. This work has also involved integrating records held by other organisations, such as the RCAHMW, including large numbers of wreck sites recorded in the Milford Haven area. An attempt has been made to identify the known or suspected location of many of these wrecks, but this extensive work is still ongoing, see Appendix 1; Mapinfo Tables – 'B:Wrecks'.

[1] The presence of Bluestones at Stonehenge has led to protracted debate regarding their transport from the Preseli Hills to Salisbury Plain. If it is accepted that some form of raft or boat was used to float the stones down the Haven to the river Avon during the Neolithic, then it is possible that evidence for sunken Bluestones and/or Neolithic craft may exist within the waterway (Bates, *et a*l 2004: 3.3.3).

Assessment of the known resource
A brief review of documentary sources, pictographic evidence and cartographic sources was undertaken. This also included a review of previous archaeological work recorded within the study area. Due to the wealth of information available it was not possible to examine all the relevant sources, but where possible an attempt has been made to identify the main holders of further information, see Appendix 2; Contacts and Consultations.

Digital Mapping
Extensive work has been undertaken to produce the layers of digital mapping. As part of the HER enhancement this has included;-

- Point data showing the HER sites (See Appendix 1; Mapinfo Tables – 'A:HER sites').
- Point data showing known, suspected and general locations of wrecks sites believed to lie within the Milford Haven Waterway area (See Appendix 1; Mapinfo Tables – 'B:Wrecks').
- Point and polygon data showing designated sites within the study area, specifically Listed Buildings and Scheduled Ancient Monuments. (It is noted that any such digital data will not be taken as definitive and will be labelled accordingly) (See Appendix 1; Mapinfo Tables – 'C: Designated sites').
- Polygons showing the areas of previous archaeological investigations within the study area, suggesting where further information on specific area may be found (See Appendix 1; Mapinfo Tables – 'D: Archaeological Investigations').

As part of the work done in studying the maritime history and development of the Haven digital maps have been created primarily from historic and modern map sources illustrating:-

- The development of ports, quays, harbours and other similar maritime features within the Haven over the past c200 – 250 years (See Appendix 1; Mapinfo Tables – 'E: Ports, Quays, Harbours').
- The development of industrial sites that relied heavily on the Haven for their function and development over the same time period (See Appendix 1; Mapinfo Tables – 'F: Industrial Areas').
- The development of the military use and protection of the Haven over the same time period (See Appendix 1; Mapinfo Tables – 'G: Military').
- Historic settlement extents and development (See Appendix 1; Mapinfo Tables – 'H: Settlements').

As part of the aim to identify areas of archaeological potential and threats to the archaeological resource digital maps have been produced illustrating:-

- Areas of archaeological potential within the study area, both within the waterway itself and on the land that lies along the waters edge (See Appendix 1; Mapinfo Tables – 'I: Threats & Potential').

Identification of archaeological potential
Through a study of known archaeological sites and an understanding of the development and use of the Haven it is possible to highlight areas that have the potential to contain further archaeological remains that as yet have not been identified. Two layers of digital mapping have been produced to illustrate the different areas of both sub-marine archaeological potential and land-based archaeological potential, see Appendix 1; Mapinfo Tables – 'I: Threats & Potential'. These numerous individual areas were then broken down into broader groups and areas of high, medium and low archaeological potential were identified. Explanations of the archaeological potential are included within this report, see Maritime and Associated Archaeological Potential and descriptions of the individual

areas of potential as illustrated by the digital mapping is provided in the Appendix, see Appendix 3; Waterway Potential and Appendix 4; Land Potential.

Contacts and consultations

Initial contact was made with representatives of a variety of interest groups and stakeholders in the Milford Haven area including the Milford Haven Port Authority (MHPA), Pembrokeshire County Council (PCC), Pembrokeshire Coast National Park (PCNP), Countryside Council for Wales (CCW), PLANED, Pembrokeshire Coastal Forum, National Trust, West Wales Maritime Heritage Society, Chapel Bay Fort & Museum, Pembroke Dock Museums Trust, Sunderland Trust Project, West Wales Divers, University of Wales Lampeter and various other interested groups and individuals. A scoping meeting was held with various members in February 2007 to help shape the aims and outcomes of this project. Contact has been continuing as time has allowed throughout the project, exchanging ideas, information, resources and contacts. It is hoped contact between the various parties will remain ongoing as a result of this project.

A guide to using the results of the study

General threats to the maritime archaeological resource have been identified. The legislation and processes that protect and affect the archaeological resource have also identified and explained, and the roles of various stakeholders operating within the study area are highlighted. Explanations are provided as to how this report could be of use, and could be used by the variety of different stakeholders and parties that may be interested in and affected by the maritime archaeological resource within the Milford Haven Waterway area.

Production of the Report

This report is intended to be a concise document and includes summaries of the following:-

1. Description of the study area.
2. An overview of the maritime history of the Haven.
3. A brief assessment of the known archaeological resource.
4. A description of the historical development of ports, industry, military and settlements within the study area over the last c200 years of intensive development.
5. A brief description of the identified ports, quays and harbours within the study area.
6. An overview of the maritime archaeological potential and threats and protection of that resource.
7. A description of the conservation and management of the historic environment resource and a guide to using the results of this study.
8. Appendices describing the GIS layers, the various information holders and key stakeholders that have been involved with this project and descriptions of the identified areas of maritime archaeological potential.
9. Historical and contemporary sources (including those consulted during the study and those identified but not consulted).
10. Maps produced to illustrate the GIS mapping work.

Archiving

Once the assessment has been completed, the paper and digital record generated will be archived in the following way.

- Paper records (written notes, photocopies, traced maps etc) will be organised.
- Any records that duplicate information stored in the HER or any other databases will be discarded.
- The remaining paper record and photographs will be stored in the HER/NMR.

Project Outcomes

In addition to the GIS layers and this supporting report with guidance on their use, one of the main outcomes of the project is to develop and maintain working partnerships and links with key stakeholders, and to encourage the future use of the results of the study. It is hoped that this will also result in the continuing enhancement of the HER. Another outcome of the project will be the widespread sharing and dissemination of information to all key stakeholders, including Cadw, the Milford Haven Port Authority (MHPA), Pembrokeshire Coast National Park Authority (PCNPA) and Pembrokeshire County Council (PCC), with the aim of informing the planning process and contributing to the protection of the maritime historic environment. This is in response to current concerns for maritime heritage as raised by Rees (2003). The project has also seen strong community engagement, with various local community groups and societies wishing to be involved in contributing their time and knowledge to the project on a rolling basis. Two further meetings with stakeholders will be organised to demonstrate the results of the study and how the GIS layers can be used.

At a scoping meeting held with some of the key stakeholders it was suggested that a web-page, hosted by Dyfed Archaeological Trust, would be an effective way of disseminating the results of the project, particularly in identifying resources available for further study. This web-page would also include links to the websites of the key stakeholders and local interest groups, acting as a portal for anyone interested in finding out more about the heritage of the Milford Haven waterway.

THE STUDY AREA

> 'The Milford Haven waterway is a ria or drowned valley flooded after the end of the last Ice Age; its deep yet sheltered waters extend 30km inland of its mouth, before dividing into the Eastern and Western Cleddau which continue as tidal rivers for some distance. Tributaries such as the Pembroke, Carew and Cresswell Rivers and several smaller pills flowing into the Haven, significantly increase the length of its meandering and incised shore and coastline. On either side and extending to the Dale and Angle peninsula's at the Haven's mouth, the low coastal plateau of south Pembrokeshire seldom rises above 80m above OD.
>
> 'The littoral landscape of Milford Haven encapsulates the whole chronological range of maritime conquest, settlement, commerce, fishing and defence from the 11th century to the changing realities of the late 20th century. This is a highly articulate and distinctive land and seascape; its integrity is its highest factor. It exhibits both continuity and adaptation and its overall setting and range of features make it unique in Wales if not in Britain. Yet, despite its robust adaptation to the modern industrial and maritime operations of the oil and power industries, the integrity of this multiperiod coastal landscape also depends on the conservation of its historic elements'
>
> (Murphy & Ludlow 2002, 17-18)

Initially the study area comprised the entire Registered Historic Landscape of Milford Haven Waterway from which the description above is taken, but this was refined to include only the areas that could be shown to have a direct connection with the waterway itself. This varied throughout the Haven from just a few metres of inaccessible cliff face in some areas to extending almost a mile inland to incorporate inland forts and WWII airfields built as part of the defence of the Haven but placed away from the waters edge.

The geology of the Milford Haven area consists mainly of Devonian rock, as opposed to the older Ordovician and Silurian rocks that predominate in northern Pembrokeshire. Geological pressures have lead to extensive folding in this area, resulting in bands of a variety of different rock types. At the northern reaches of the Cleddau lie bands of Millstone Grit and Old Red Sandstone, with coal measures stretching from Carmarthen Bay through to St Brides Bay occurring in the area where the two Cleddau meet. South of this lies mainly Old Red Sandstone, interspersed with bands of Carboniferous Limestone, Millstone Grit and sedimentary rock, with the occasional outcrop of igneous rock. Through this sequence, in a line roughly from Tenby to Dale, runs the Ritec Fault, a major fault that formed the basic outline of the valley that was to become the Milford Haven waterway. It appears to have been the rapid deglaciation that followed the glacial maximum of the last Ice Age in c.18,000 BP (Before Present) that lead to the gouging out of the main channel of the Haven (resulting in rapid flooding and perhaps the development of over-deepened channels). Smaller tributaries such as the Carew and Pembroke rivers eroded courses through the softer limestone bands. Initially sea-levels in the Haven could have been up to 30m below the present levels but rose rapidly from the end of the Ice Age to around c.7500 to 6000 years BP, when sea-level rise began to slow down, eventually reaching near current levels around 4000 years ago.

THE KNOWN ARCHAEOLOGICAL RESOURCE

Historical Documentary Evidence

There is a wide range of historic documentary references to Milford Haven in general and to specific sites within the study area. References come as early as the 2nd century AD in Ptolemy's Geography which includes an outline of the coast of Pembrokeshire and what may be St Ann's Head named as Octapitarum. During the medieval period this area included the seat of power for the powerful lords of Pembroke, and as an important staging post for Henry I's invasion of Ireland and Owain Glyndwr and Henry Tudor invasions, consequently references to the importance of the Haven are relatively common. Documents also survive as charters, grants, deeds and so on for medieval settlements, castles and monastic sites. Port Books for the Milford Haven area also stretch back into the medieval period, listing ship registers and giving an indication of major ports and trade. All can be used to build up a complex picture of the development of this part of Wales, this work has been adequately achieved in other works and need not be reviewed in detail here (Edwards, S., 2001; James, D., 2006; McKay, K., 1992)

During the 16th century as the threat of Spanish and French invasion loomed proposals were put forward for a defence of the good harbouring and landing points that the Haven offered. Due to this we are fortunate in the survival of some early maps, such as Paul Ive's (military engineer for the crown) map of 1595 and George Owens description of the Haven in the same year.

The maritime military importance of the Haven has resulted in a good collection of detailed and early Ordnance Survey maps from the mid 19th century onwards. These include detailed maps of 1;500 scale for the settlements of Pembroke, Pembroke Dock and Haverfordwest, along with a variety of 1;2500 Ordnance Survey maps from the 1860's through to the 1890's. Earlier map coverage can be found in the tithe maps of the 1840s and various estate maps of the 18th and early 19th century, whilst more general maps of Milford Haven in the 17th and 18th century also provide interesting detail, such as Lewis Morris map of 1743 or Bell's plan of Milford Haven in 1758.

Standing buildings

There are 410 listed buildings within the study area, but this is only part of the range of the historic buildings that can be found, from a wide date range, that help to provide a complex and detailed picture of the history and development of the Milford Haven area. An impressive array of major medieval structures survive, such as the numerous castle sites, churches, priories and chapels, along with smaller buildings and features such as dovecotes and wells. The majority of the listed buildings are post medieval structures and include a wide range of domestic, religious, maritime, industrial, military and commercial structures charting the success and expansion of settlements around the Haven during periods of significant change in the 18th and 19th centuries. More recent structures are often overlooked but also reveal a great deal about the development of the Haven, such as the many recent wartime structures that now often lie derelict and overgrown. The importance of these structures is being realised however, and has lead to important military and industrial structures of the 20th century, such as the Sunderland hangar sheds in Pembroke Dock, being recognised and protected.

Archaeological Sites

Within this study area there are 2169 recorded sites within the HER, which represent only those sites specifically connected to the waterway itself. Of these sites 54 are designated as Scheduled Ancient Monuments. As a result of this study a further 162 new sites have now been added to the HER.

Wrecks
There are a variety of sources of information regarding the potential and identification of wrecked vessels within the Haven. The National Monuments Record includes records for a total of 246 wreck sites from the Milford Haven Waterway. These include vessels identified from Larn, R and Larn, B *Shipwreck Index of the British Isles* (London, Lloyd's Register of Shipping, 1995-ongoing). This comprehensive listing of all wrecks by UK coastal area identifies all vessels lost rather than those with known surviving wreckage. The Hydrographic Office identifies known wreck sites which form shipping hazards. The Receiver of Wreck has recorded 35 instances since the late 1990s of the reporting of wreck within the Haven Waterway. These include material from known vessels including Loch Shiel (built Glasgow 1894), a Sunderland Flying Boat, HMS Barking, Caroline, Dakotian, etc.

In total of 297 wreck and wreck sites, including find spots, have been identified within the Haven through this study.

Archaeological Interventions
There has been a wide range of archaeological interventions throughout the study area, of varying degrees of intensity. These can range from desk-based Assessments to field surveys including topographic surveys, geophysical surveys, building recording and photographic records. More intrusive archaeological investigation has also been undertaken, from watching briefs to evaluation and full-scale excavations.

There are too many to go into detail within this report, although a GIS mapping layer has been created depicting the areas covered by various archaeological interventions (see Appendix 1; Mapinfo Tables – 'D: Archaeological Investigations'). A small number of the earlier archaeological excavations, of the 19th or earlier 20th century, are not included in this mapping layer due to a lack of detailed reports associated with these investigations.

In brief they have provided a wide range of information about the Haven and developments alongside it that can range from local to national importance. Some of the earliest evidence of human presence in Wales has been recorded from excavations within Priory Farm Cave, near Pembroke (David, A.,1991). Surveys undertaken by TEAM have identified the potential for Palaeolithic and Mesolithic land surfaces surviving below the water, which can be evidenced in side-scan and bathymetric surveys and borehole data (Bates, C, et al. 2004). Boreholes and field surveys also demonstrate the survival of important palaeo-environmental deposits throughout the Haven. Survey work and excavations have revealed and recorded much of the evidence of prehistoric settlement in the area, from Bronze Age round houses excavated on the site of the Esso Oil Refinery (Crane 2004) to Iron Age hillforts, such as Dale Point excavated between 1963 and 1983 (Benson & Williams 1987). Early medieval cemeteries and metal-working sites have also been revealed in various excavations. Desk-based assessments, watching briefs and excavations have recorded details of the medieval world, and the surviving physical evidence can be surveyed, photographed, recorded and studied. Survey work has revealed a great deal of surviving evidence from our most recent past that would otherwise have been overlooked and lost, such as the wealth of 20th century military structures that are often removed without adequate recording.

Geo-technical Surveys
Various geo-technical reports have been undertaken within the study area that can also be of use to archaeology. Borehole work has been undertaken along the main waterway channel, and near the mouth of the Pembroke River, recording sediment survival and bedrock. This information can be used to assess the potential for the

survival of now submerged Palaeolithic and Mesolithic sediments throughout these areas.

Geophysical surveys, side-scan surveys and acoustic bathymetric surveys have been undertaken over large areas of the waterway. Ostensibly these surveys were undertaken to identify below-water levels, rockhead data and sub-marine habitats, but they can also help identify areas of potentially important sediment as well as specific archaeological features such as wreck sites.

EARLY MARITIME HISTORY OF THE HAVEN – AN OVERVIEW

Hominid activity in Wales is known from around 225,000 years BP, but human settlement appears to have begun in the middle Palaeolithic (50,000-26,000 BP), prior to the last Ice Age. Some of the most significant remains of early human activity to be found come from Paviland Cave on Gower, where a human burial dated to around 29,000 BP has been excavated. However, evidence of a human presence in this part of Wales begins to increase from c.13,000 BP onwards, towards the end of the last Ice Age. Much of this evidence comes from cave sites, such as Hoyles Mouth Cave near Tenby, Cathole cave on Gower, Nanna's Cave on Caldey but also from Priory Farm Cave in the limestone cliffs near Pembroke.

Nomadic human groups are known to have moved through the area during the Palaeolithic and Mesolithic periods, when the landscape would have been markedly different from today. Flint scatters indicate these groups at least paused long enough to create their stone tools, but evidence of their physical settlements remains to be discovered, with many such sites perhaps now lying beneath the water. Priory Farm cave near Pembroke is perhaps the best evidence we have in this area for a settlement site. Excavations in the 19th century revealed a range of flint tools dating from the Upper Palaeolithic and Mesolithic, representing the westernmost extension of final upper Palaeolithic technology. Associated bones indicated contemporary fauna included hyena, mammoth, reindeer and a now extinct species of wild horse. The earliest remains from this cave date to around 10,000 BP, when sea-levels are believed to have been anything from 20 to 30m lower than present levels, so the small sheltered inland Pembroke Valley would have opened out into a wide deep valley with a much narrower river running along the base. During this period vast open grassland plains with a few shrubs and trees were developing, and the valleys of Milford Haven would have provided a wealth of resources exploited by early human visitors to the area. As sea levels continued to rise rapidly during this period these areas became submerged and have the potential to survive relatively undisturbed.

The Priory Farm Cave also produced finds dating from the Mesolithic period (10,000 – 4400 BC), indicating not only a long period of occupation within this particular cave but also the increasing evidence of human activity in the Milford Haven area. The regional Historic Environment Record (HER) lists 45 possible Mesolithic finds within the study area, comprising lithic scatters and flint-working floors as well as some isolated finds, both from cliff top locations and cave sites. During this period these cliffs would still have overlooked coastal plains and river valleys of the Haven, with sea level rise slowing as it began to approach current levels. Mesolithic exploitation is likely to have been based on seasonal movement between camps, exploiting a variety of different, often seasonal resources, but this does not exclude more permanent settlement. Indeed known Mesolithic settlements such as Goldcliff, near Newport, appear to have been occupied during the winter and spring months with people making use of all the available local resources, including those offered by the local marine and estuarine environments. Other sites, such as Rhuddlan, have been argued as having even more permanent settlement with specialist groups exploiting different local and regional resources (Murphy in Davidson 2002). Riverside locations within the Haven would have offered a similar wide range of resources that could be exploited by the Mesolithic population, although these landscapes became increasingly submerged. Evidence of prehistoric activity and post-glacial land surfaces from the Upper Palaeolithic and Mesolithic periods can therefore be reasonably expected within the submerged sediments of the waterway.

By the Neolithic period (4400 –2300 BC), the sea level had reached something approximating its current levels and as a result of sea level rise, early farmers were forced to retreat onto higher ground: not only this, there had been considerable climatic and vegetational change during the late Glacial and early Holocene, which had dramatically altered the flora and fauna of the area. A combination of deglaciation and vegetational change had therefore fundamentally altered the landscape of the lower Haven, impacting on the resource base for contemporary populations, modifying the location of preferred occupational sites and disrupting long established communication networks (Bates, *et al* 2004: 5.1). A consequence of rapid deglaciation and sea level rise during the late Pleistocene and early Holocene was the formation of a drowned ria, now the Milford Haven, which created a natural harbour and sheltered waterway which has remained much the same as it is today since the Neolithic period. In terms of its maritime history, it could be suggested that the Haven's earliest maritime activity therefore dates back to the Neolithic, when the famous Preseli Bluestones were potentially floated down the Haven to the Avon, travelling not overland but by sea from Pembrokeshire to Wiltshire to be incorporated into Stonehenge. The introduction of non-native plants and animals for food production during this period may also imply an arrival by sea and broad similarities between megalithic chambered tombs in Wales and Ireland indicate possible trading links with both Ireland and the Continent. This suggests a potential tradition of boat-building and maritime activity along the Welsh coast, in which the Milford Haven Waterway is bound to have played a part.

This is generally considered to be a period when human groups were beginning to establish more permanent settlements. However, once again evidence of such settlemenst is scarce, their presence suggested once more by collections of flint tools and evidence of their manufacture. The appearance of burial mounds and burnt mounds may suggest population levels were increasing during the Bronze Age, or at least the physical evidence of their presence survives better. Bronze Age finds and human bones indicate people had moved back into the cave at Priory Farm, presumably during a climatic deterioration between c.1100 – c.700 BC. Evidence of their settlement has also been found elsewhere. During excavations at the former Esso refinery site the remains of two Bronze Age round-houses were discovered, a rare discovery in Wales (Crane 2004). Earlier excavations at the large later promontory fort on Dale Point also revealed that its origins lay in the Bronze Age (Benson & Williams 1987), along with the number of other Bronze Age finds in this area may suggest extensive settlement on the Dale peninsula.

Some of the earliest boat remains and possible portside structures to be discovered in Wales date to the Bronze Age (2300 – 700 BC). Boat-planks have been excavated in Caldicot, Monmouthshire, while the recent excavations on the LNG pipeline through Pembrokeshire identified a Bronze Age wooden object which has been provisionally interpreted as a dug-out canoe. A simple port is postulated from Bronze Age structures discovered in Merioneth with major maritime trade suggested by the coastal location of the major copper mines on Great Orme. The 2006-7 excavations at the former Esso refinery at South Hook have revealed at least two Bronze Age structures, of either domestic or industrial origin: their association with the numerous Bronze Age funerary and ritual monuments located in close proximity to the waterway would appear to suggest continued occupation in the area of the Haven during this period, and a possible exploitation of the marine resource by these Bronze Age settlers (Crane 2004).

The record of Iron Age (700 BC – 43 AD) activity in the study area, as with much of Wales, is dominated by defensive sites. A large number of impressive coastal promontory forts were constructed taking advantage of the excellent defensive locations offered by the high cliffs and coastal slopes. Dale Point is probably one of the best known examples, which also appears to have its origins in the Bronze Age,

but there around 20 to 25 other examples of promontory forts within the study area, of varying size and complexity dating to all periods of the Iron Age. It is likely that these represent only a minority of the Iron Age settlements in this area, as undefended settlements are notoriously difficult to recognise. The maritime connection of these forts is still open to debate. Their coastal locations may indicate they were sited specifically with the aim of defending the waterway or against attacks from the waterway, or they may be fortuitously sited due to the convenient defensive opportunities provided by coastal locations, intended more as refuges from land-based attacks. Little work has been carried out to ascertain how much these promontory forts relied on the waterway for their resources, the cliffs and coastal slopes that defend some sites would clearly make any access to the water difficult, others are better placed to take advantage of sandy coves and natural harbours. Even if the forts were not designed to defend the Haven some at least must have relied on a variety of local resources for their existence which is likely to include maritime resources. From the Neolithic period onwards Milford Haven has offered one of the best natural harbours along the coast of Wales and it would seem likely that such a harbour would be known and utilised by any coastal trade during the Iron Age period. The number of promontory forts clearly indicates population levels in this area would have encouraged and sustained some trade.

Very little is so far known about the Roman (43 – 410 AD) use of the waterway, it is highly likely that the Roman military would have known and made use of it, although the only recorded sites from this period within the regional HER consist of isolated finds with some occupation material recovered from within Dale Point fort. Haverfordwest has been cited as a possible site for a Roman fort, but evidence of this, other than a few stray finds from the area, has yet to come to light. Ptolemy's Geography, written in the 2nd century AD, clearly indicates the Romans had a good knowledge of the coast of Wales and features an outline of Pembrokeshire that may show St Ann's Head, named as Octipitarum (although St David's head has also been cited as a likely alternative). Coastal military and civilian sites elsewhere in Wales attest to a flourishing coastal trade during much of this period. The layout of settlement in much of Pembrokeshire during this period is not clearly understood but Haverfordwest has been identified as a possible location for a Roman fort, which is likely to have well-established wharves and quays. Coastal trade may have been disrupted in the later Roman period as raiding from Ireland increased, but this also lead to an increase in coastal fortification that may have impacted on the Haven.

Post-Roman settlement, in the centuries between the 5th and the late 11th also lie undiscovered, although their existence can be inferred from church and cemetery sites, village morphology and later medieval activity. With the ending of Roman administration and the disruption to Roman trade networks caused by the collapse of the empire, trade reverted to a system based around the Irish Sea area. Milford Haven is well placed to take advantage of these Irish trade routes. This period is sometimes termed the 'Age of the Saints', and religious pilgrims and missionaries are known to have been travelling throughout this area during this period. Ecclesiastical sites form the bulk of the known early medieval archaeology within this study area. Maritime links may be emphasised by ecclesiastical and burial sites in coastal locations along the Haven. St Ishmaels, Carew Cheriton, Lawrenny, Llanstadwell, Rhoscrowther and Pwllcrochan church are all likely to have their origins in the early medieval period, whilst Monkton and Sheep Island are also likely sites for monastic enclosures. Cemeteries have been found at St Anthony's Chapel near Angle, Brownslade, Castlemartin and Longoar Bay near Great Castle Head for example, and churches at Lawrenny, Carew and Llanstadwell amongst others have their origins in the early medieval period.

The archaeological significance of these Early Medieval coastal cemeteries is considerable. They provide rare opportunities to understand more of the religious, ritual and burial practices of the time, suggesting a strong religious importance to coastal locations. However, they can also add significantly to our scant knowledge about early medieval society. For example study of skeletal evidence from excavations at Brownslade has provided an insight into the everyday working life and diet of the local population. Many of these sites are extremely vulnerable to coastal erosion and the rising sea levels resulting from climate change is increasing the threat to these sites.

What is not currently known is the level of settlement around these cemetery sites. Certainly during the medieval period settlement would often develop around important religious sites, but whether this was true of the early medieval period as well is not clear. There is a suggestion that Pembroke was either a major settlement or seat of power during this period, based on the fact that the invading Norman army in 1093 made straight for this location and established it as one of their main bases of power and settlement in the region. Monkton priory may also have been the site of an earlier monastery. One secular and one ecclesiastical site next to each other is a feature seen at other early medieval sites such as Tenby.

It is also known that the Vikings sheltered in the Waterway during the early medieval period between c.790 and 1066 AD. Hubba, a Viking chieftain, wintered in the Haven with 23 ships in 854 AD, and links between the area and its Viking past is reflected in local place-names, such as Hubberston and Freystrop. Recent excavations by Cambria Archaeology at the former Esso refinery/South Hook LNG site in 2004 (Crane 2004) have revealed evidence of iron smelting and corn drying, with radiocarbon dates clustering around the 780-890 AD range (Crane, pers comm.). It is unclear as to whether this is evidence of indigenous local settlement and industrial activity or a reflection of Viking over-wintering in the Haven, but perhaps the most interesting discovery was in the smelting technique employed on the site, which reflected a technology thought to have been lost in Wales following the collapse of the Roman Empire (Murphy, pers comm.).

The 11th century Norman conquest, achieved by the use of coastally sited castle-boroughs, remains evidenced within Pembroke, Haverfordwest and Carew, all located within the upper reaches of the rivers which run into the Haven (Murphy and Ludlow 2002: 18). These castle-boroughs were placed on the waterway to allow them access to sea-borne supply lines as well as extra manpower or troops if required. As these new settlements became established they engaged in trade and commerce, the success of which required good transport links which in this area in particular often meant maritime transport. Many of the smaller medieval settlements, such as Herbrandston, Steynton and Waterston did not have obvious connections with the waterway and therefore probably relied more on agriculture for their income, but other medieval settlements such as Dale and Angle are likely to have established strong links to the waterway during this period. Fishing, coastal trading and small-scale boat building would have been undertaken from the numerous small creeks and inlets along the Haven. Physical evidence of medieval wharves and quays is surprisingly scarce, but it may be the very success of these sites that now obscures the medieval harbours, as wharves and quays develop they expand out and over the earlier remains. It is also likely that in many of the minor creeks and inlets beaching craft would have been typical. Fish traps probably represent the best surviving evidence for economic exploitation of the coast in this period, possible examples can be seen within Castle Pill. The military potential of the deep harbour of Milford Haven is also clearly illustrated during the medieval period. The waterway was used as a mustering point for the Anglo-Norman invasions of Ireland in the 12th century, and in the 15th century the Haven was chosen as an invasion landing-place by both Owain Glyndwr and Henry Tudor.

Many of the settlements in the Milford Haven area have their origins in the medieval period. The Anglo-Norman invasions of the late 11th century established two main power bases in the Milford Haven area. The invading Earl of Shrewsbury, Roger de Montgomery, established his base at Pembroke, and it was from here that his son Arnulf was able to subjugate the southern half of the county. Their castle was established in a former Iron Age hillfort, and within what may have been an important early medieval power centre. A town was laid out along the ridge, defended by the Pembroke river on one side and Monkton Pill on the other, which would later be supplemented by a stone wall. The town was ideally placed not only to be defended by the waterway, but also to make use of the trade and communication routes that the waterway offered. In 1138 Gilbert de Clare, based in Pembroke, was granted the newly created Earldom of Pembroke by King Stephen and the County of Pembroke was granted Palatine (semi-independent) status. The town continued to expand throughout the medieval period, but it was soon outstripped by the other major centre of medieval power at Haverfordwest. This town also developed alongside a castle during the 12th century, defended on the east by the Western Cleddau, and later walled. By the 13th century the emerging town was attracting English and Flemish traders and settlers and soon became one of the largest medieval towns in Wales.

Similar though smaller settlements were developing all around the Haven in the medieval period. Several settlements were established in a planned manner during the medieval period. This is perhaps evidenced at the major towns of Pembroke and Haverfordwest with burgage plots laid out extending off the main street, but one of the best examples is probably Angle. Here a single street ran along the valley base with fairly regularly sized burgage plots extending off the street, with a concentrated area of high status activity around the church and manor house towards the eastern end. Surrounding these burgage plots an open field system of agriculture was laid out, with large 'open field' subdivided into narrow strips that could then be divided amongst the village farmers. These narrow strips would often later become fossilised as farmers established field boundaries to isolate their property, resulting in the 'strip fields' that can be seen in various places throughout the Haven. This village layout has remained fairly stable through into the present day, whereas modern development in other similar villages has masked this earlier medieval planning. Dale may have been planned in the 13th century along two streets, whereas St Ishmaels and Carew both show a single street extending away from a castle site.

Other villages exhibit a more radial pattern of development, often around an important central point such as a church. This has been argued to represent pre-Norman settlement centres, as might be possible at Rhoscrowther. In some cases medieval settlements were not grouped together in a single organised location, with the major features separated to take advantage of local resources or existing sites. This is illustrated by Carew, the castle and administrative centre was established by the river, in a location suitable for defending and also possibly on the site of a previous early medieval centre of power. A small settlement was laid out in front of the castle, but this never appears to have grown to any great size. The religious centre of the settlement however was based around St Mary's church, which was already an ecclesiastical centre by the time the Anglo-Normans arrived. A small settlement may already have been in existence here, and continued to be occupied throughout the medieval period, now known as Carew Cheriton. Earthworks visible around the village may also suggest it was formerly a larger settlement. The industrial centre of the village was the mill, but this required a suitable water flow to power the mill, which initially was to be found on the upper reaches of Radford Pill. As another major centre a small settlement grew up around this site, now known as Milton.

During the following centuries settlement appears to have developed in a more organic way, around existing settlements and important centres, and also alongside natural resources, such as along the shoreline at Llanstadwell. Many settlements have expanded gradually, although settlement never appears to have been particularly intense until the industrialisation of this area in the late 18th and 19th century. Expansion is not the case for every settlement, however. The shifting of power from Pembroke to Haverfordwest throughout the medieval period, coupled with a general economic downturn in the late medieval period affected Pembroke and neighbouring Monkton badly. In c.1600 Pembroke is described as 'very ruinous and much decay'd' (Owen) and by c.1610 maps of this area show no settlement at all in the Monkton area (Speed). Other small settlements have also contracted to small hamlets or farmstead since the medieval period, such as Pwllcrochan and Minwear, whilst some have disappeared completely such as Popton and Burlaxton. Other settlements have also shifted away from their traditional centres, such as the medieval settlement of Pill. This once important medieval manorial centre was based around Castle Pill and was presumably laid out around the castle site, established within an Iron Age hillfort at the head of the pill. The caput of the manor had been transferred elsewhere in 1577 and by the 17th century maps appear to indicate the settlement had moved further down, developing alongside the banks of the pill, whilst more recent development had subsumed the settlement into part of Neyland.

POST MEDIEVAL AND MODERN DEVELOPMENT

Settlement

The main period of settlement change within the study area has occurred during the last 250-300 years, with the establishment of Neyland, Milford and Pembroke Dock. It is possible that a small settlement had grown up around Neyland by the 18th century, supporting small-scale fishing, trading and shipbuilding. An expanding fishing industry meant that between 1751 and 1782 Neyland had become one the largest herring ports in Wales and the adjacent pill was chosen by the admiralty in c.1760 as a naval shipbuilding site. Naval shipbuilding may have been abandoned in the 1780s but private shipbuilding and fishing continued supporting a small settlement on the western side of the pill mouth, along what is now Station Road. Modest port facilities are recorded by the early 19th century, such as a salt refining works in Barnlake but it was not until the site was chosen by Brunel to site the SWR railway terminus in 1852 that settlement expansion really took off. The layout of the settlement was changed, much of the old settlement was swept away as new port facilities were built around the terminus. A large pier was built, and a ferry service to Ireland was established. Hotels and Inns sprang up in the town, new industries arrived and settlement began to expand away from the waterfront. The ferry service was transferred to Fishguard in 1906, Neyland continued as a successful fishing port until the 1920s but then began to go into decline, eclipsed by Milford Haven. The later 20th century however was a period of general settlement expansion and many new houses were built in Neyland, eventually linking with the medieval settlements of Honeyborough and Llanstadwell. The establishment of the marina in the adjacent pill has lead to further revitalisation of the town.

Unlike Neyland, Milford Haven was a new establishment in the late 18th century. Sir William Hamilton inherited properties in the Milford Haven area in 1782, when the area was occupied by small fishing villages at Hubberston, Pill and possibly also Hakin. At this time there was concern in the naval world about a lack of a supply base in this area for the navy and long-distance trade, Hamilton saw the potential offered by his new properties and applied to Parliament to allow him to establish a port. In 1790 an Act of Parliament allowed him to 'make and provide Quays, Docks, Piers and other erections and establish Market with proper Roads and Avenues'. In 1793 Quaker whalers from Nantucket were attracted to settle at the newly emerging port and until a price crash in 1819 a successful whaling fleet operated from Milford Haven/Hakin. In 1797 the Navy Board were persuaded to establish dockyards in Hubberston Pill. Settlement spread along the riverfront at Hakin but a new settlement was laid out in a distinctive grid-iron plan on the opposite side of the pill. The naval docks were defended by two batteries, each with their own barracks attracting further military settlement to the area.

The port soon outgrew its location however, and the Naval docks were transferred to a new purpose-built site at Paterchurch, later renamed Pembroke Dock, in 1812-14. The town soon went into decline, further depressed by the transferring of a steam packet service to Ireland across to Hobbs Point, and the choice of Neyland to situate the major railway terminus in 1856. Plans were proposed to construct new quays, piers and docks to help revitalise the struggling town but nothing was done until a town improvement bill of 1857 lead to building of Black bridge and Hakin bridge, opening the town up to easier overland access. This was further boosted by the arrival of a railway spur line in 1863. In 1874 the Milford Docks Company was formed and in the 1880s new docks were opened, initially intended to operate as a transatlantic ferry service. The ferry service proved impractical but the docks became home to a large and successful fishing fleet, and small shipyards were established, especially in Castle Pill. Milford Haven rose to become one of the chief fishing ports in Britain, soon eclipsing Neyland. The original passenger sheds were converted to a fish market, extended in the 1930s, ice factories were built in the

1890s, a mackerel quay and market were built in the early 20th century and numerous smoke houses are recorded throughout the town. Settlement now began to expand beyond the original grid-iron layout, connecting the former dispersed villages that dotted the area. A severe decline in the fishing industry in the late 1950s lead to the stagnation of the town but recent redevelopment and the establishment of a marina has allowed continued settlement expansion.

In 1812-14 the naval docks were transferred to an undeveloped area, partly occupied by a semi-built fort, at Paterchurch. As with Milford Haven settlement was laid out around the docks in a grid-iron pattern, and growth was rapid. The docks were extended in 1830-32, and again in 1844, becoming one of the worlds most important naval shipbuilding centres. The defence of the naval docks was initially provided by large number of Royal Marines, soon supplemented by a series of forts and batteries. This military presence boosted the population on the peninsula and several barracks were established around the town. Civilian dockyards were also established on the waterfront and the town began to spread east and south away from the docks. A stone pier had been built at Hobbs Point in 1832 and the Irish steam-packet service was transferred here, leading to increasing settlement around this point. Llanion barracks located here also expanded rapidly across the headland behind Hobbs Point. This soon connected with a small settlement, with possible medieval origins, that had developed around the local ferry point of Pembroke Ferry. By the early 20th century larger ship technology meant the facilities available at Pembroke Dock were becoming outdated, and the dockyards closed in 1926. They were soon partly reopened becoming a Sunderland flying boat station in 1930 and the world wars of the 20th century meant a military presence remained constant. This presence declined after the end of the 2nd world war but former military sites and barracks were gradually replaced by civilian settlement expansion. Industrial expansion in the later 20th century has expanded Pembroke Dock across the headland as far as Cosheston Pill to the east.

The arrival of major refinery sites in the lower Haven in the later 20th century has provided a major boost to population levels in the areas. Large numbers of settlements have seen new building expansion over the past 50 years.

Ports, Quays And Harbours

Pembroke had been one of the major power-bases during the medieval period but suffered a dramatic decline by the end of the end of the medieval period. By the end of the 16th century, despite the establishment of a customs house within the town, very few vessels were registered there, and only a relatively small trade mainly in cloth, wool, corn and herring was undertaken. Medieval charters suggest a quay was established against the northern Mill Bridge, later supplemented by a second quay close to the southern Monkton Bridge. The sheltered cove of Monkton Pill at this point is also likely to have been well-used by any boats offloading and picking up goods.

By the end of the medieval period Haverfordwest had become the largest population centre in the Milford Haven area and was taking the bulk of the trade on the waterway, lying at the junction of several of the main overland routeways. Medieval mercantile activity is recorded at the quayside in the town, which remained a relatively busy area of activity until the establishment of major ports in the lower Haven and silting of the upper reaches of river in the late 18th century.

Despite these two major medieval settlements the relatively isolated location of the Haven meant many settlements and ports in this area remained small. Well established medieval villages such as Dale and Angle are likely to have been heavily reliant on the waterway and engaged in dynamic maritime activity. Fishing was a major part of the Dale and Angle economies, as is also likely to have taken place from many of the other settlements around the coastal fringe, such as Hubberston, although agriculture probably still provided the main economic activity for most of the area's settlements. The trade in agricultural produce and equipment contributed to a healthy coastal trade however, with settlements such as Dale and Angle with convenient landing places prominently engaged in this trade. George Owen described Dale Bay as providing 'great receipte' in 1595. A similar story is probably likely from Angle although as Owen points out the presence of the Oyster Stones at the entrance to Angle Bay meant only small vessels or sailors that knew the area well would be able to enter the harbour at Angle.

Welsh Port books also indicate that some of the pills and inlets of the Haven were being used in the 16th century, in particular Castle Pill by Milford appears to have been one of the more important sites, with many boats being described as 'of Pyll'. George Owen, writing at the end of the 16th century highlights the number of suitable harbours and landing places within the Haven, but it is also clear from his writing that these places are little used. Oyster fishing was another important activity during the medieval and early post medieval era. Oyster beds at Pennar Gut were particularly famed, and remained a thriving industry until over-fishing and pollution took its toll in the 19th century.

Throughout much of the medieval and post medieval period a system of local ferries transported people and goods across the river. Small ferries crossed the pills and smaller rivers, such as those at Sandy Haven, Barnlake, Bentlass, Llangwm, Landshipping and Slebech. Larger ferry points were established at Lawrenny Ferry and Burton Ferry and eventually Irish Sea ferries were established at Milford Haven, Neyland and Pembroke Dock in the 18th and 19th centuries. This system of ferries continued in operation until many were gradually replaced by bridged river crossings, culminating in the Cleddau Bridge opening in 1975.

By the late 17th century increased economic activity and a gradual industrialisation of the area increased traffic on the waterway and lead to the establishment and expansion of many ports, harbours and quays. The exploitation of the coal measures around Landshipping, Picton and Hook lead to the establishment of major coal workings around Freystrop and Landshipping during the 18th century, whilst

Hook became a major colliery in the 19th century. Extensive quays and wharves were established along the waters edge to export the extracted coal throughout the area. Small informal local shipping places, such as Little Milford, were transformed in the 18th and 19th centuries into major coal exporting ports. New quays were also established at Hook, Lower Hook and Sprinkle. On the other side of the Cleddau quays were built at Landshipping Quay, whilst existing quayside structures at Landshipping Ferry were no doubt enlarged to cope with the increased coal activity. In the 18th and 19th century new quays and coal processing facilities were set up on the Cresswell river and Cresswell quay was established. As many of these coal-exporting sites were located in the upper reaches of the Haven exports were restricted to relatively small barges. This lead to the expansion of quays and wharves further downriver away from the coalfield, such as Lawrenny Quay, to reload the coal onto larger ships for the coastal trade.

The other major industry of this period was quarrying, making use of the river to transport the produce, men and equipment around. The limestone quarrying of the 18th and 19th centuries drastically increased river traffic. Major quarries were established along the limestone belt, such as at West Williamston, Coedcanlas, and along the Pembroke River. To allow easier river access to the major quarries at West Williamston channels were cut through the tidal marshes and docks were built to allow the stone to be loaded directly onto barges. Even the Cresswell and Carew rivers at this point were canalised to allow easier access to the quarries. Smaller channels and docks are also seen at Llangwm Quarries, Garron Pill, near Uzmaston, and along the banks of the Pembroke river.

Quarrying and coal mining reached its peak during the 19th century, but this increased industrial traffic contributed, through the dumping of ballast, to a gradual silting up of the upper reaches of the Cleddau and its tributaries. This began to restrict the flow of river traffic to the traditional ports of Haverfordwest and Pembroke, but the potential of the lower reaches of the Haven was soon realised.

In 1748 Lewis Morris remarks upon this potential, stating that 'within Pennarmouth a dock might be made which would contain all the vessels in England and which would be perhaps the greatest thing in the world of that kind'. Small-scale shipbuilding was probably already underway in places such as Bentlass and Burton Ferry. The Haven was already well known to the navy by this time, in c.1760 the Admiralty had established a shipbuilding yard in Westfield Pill by Neyland and a painting by JR Attwood of 1776 shows the British fleet at anchor in Hubberston Road. In the 1780s the government withdrew their support for the admiralty yards at Neyland but private shipbuilding continued and Neyland had already become one of the major herring fishing ports in Wales. However, the absence of a major settlement in this area to supply naval ships as well as coastal and long-distance trade was a serious concern by the mid 18th century.

In 1782 Sir William Hamilton inherited properties around Hubberston and Pill and saw the potential to remedy this problem. An Act of Parliament obtained in 1790 allowed him to 'make and provide Quays, Docks, Piers and other erections and establish Market with proper Roads and Avenues'. In 1793 Quaker whalers from Nantucket were attracted to the new port of Milford and an extensive whaling industry was established. In 1797 the Navy Board were persuaded to establish dockyards in Hubberston Pill and major shipbuilding began.

Milford suffered a decline in the early 19th century as the Navy Board relocated their shipyards to Paterchurch in 1812-14, later renamed Pembroke Dock. A collapse in the price of whale oil in 1819 resulted in the collapse of the whaling industry, and by the mid 19th century the decline was compounded by the moving of the steam

packet service to Ireland to Hobbs Point and the building of the railway to a new terminus at Neyland.

Pembroke Dock however expanded rapidly, the busy dockyards were extended in 1830-32 and again in 1844. Civilian dockyards also sprang up on Water Street, Front Street and Lower Meyrick Street during the 19th century. A substantial shipbuilding yard was also established to the south on Jacobs Pill in 1874, although it was closed 10 years later. Neyland also expanded rapidly after the establishment of the SWR railway terminus in 1856. Extensive piers and quayside structures were built and ferry services to Ireland began to operate from here. By the end of the 19th century Milford had also recovered, with the establishment of the Milford Haven Docks in 1888, and it became the home to an extensive and successful fishing fleet. Dry docks were also established at the neighbouring Castle Pill. A list of all traced ships recorded as built in the waterway, dating from the late 18th century through to the 20th century, can be found in the Ships Register in David James' *'Down the Slipway!'* (2006:127-185).

Fortunes changed again during the 20th century. The decline of the coal and quarrying industries meant the loss of much of the industrial traffic in the upper reaches of the Cleddau and the scaling down and abandonment of the former quarry and coal quays. From the mid 20th century the fishing industry also declined rapidly, affecting the major fishing ports of Milford and Neyland. New large-ship technology also soon outstripped the facilities available at Pembroke Dock which declined during the early 20th century, eventually closing abruptly in 1927. The two World Wars in the 1st half of the 20th century revitalised some of this maritime activity. Military stores were established in the Pembroke Dock, Pennar and Neyland areas, and part of the Pembroke Dockyard was re-opened as an RAF flying boat base in 1930. Maritime activity may have been scaled down and the major settlements stagnated somewhat but use of the Haven for small-scale shipbuilding, ship breaking, fishing and minor trade continued.

However, major industry returned in the later 20th century and the full deep water potential of the Haven was realised. In 1957 work began on the construction of the huge Esso oil refinery, eventually opened in 1960. The deep water of the Haven allowed large tankers to navigate within the Haven and offload enormous quantities of crude oil to refineries in the sheltered bay. Heavy industry soon surrounded the lower reaches of the Haven. A BP jetty was built in 1961, offloading oil to pump to Llandarcy in Swansea. The adjacent Texaco Oil Refinery opened in 1964, the Gulf Oil Refinery began taking tankers in 1968 and the Amoco Oil Refinery opened in 1973.

The late 20th century also saw a boom in the leisure industry, with many of the small quays, wharves and jetties within the Haven ideally placed to take advantage of the increasing use of leisure craft on the water. Today, the Haven continues to respond to maritime economic demand of a different sort, in accommodating ever-larger passenger ferries and tankers within the waterway, and encouraging tourism with events such as the bi-annual Sea Fair.

Industrial Development

One of the most visible features of the Milford Haven area today are the extensive industrial complexes of the oil and gas industry that dominate the skyline of the lower Haven. These complexes may date from the later 20th century but the Haven has long been a focus of industrial activity.

Evidence of industrial remains prior to the industrial revolution of the 18th and 19th centuries can be scarce but does exist in this area. Recent excavations by Cambria Archaeology have uncovered remains of early medieval metalworking on the site of the later Esso oil refinery (Crane 2007).

By the medieval period settlements such as Pembroke and Haverfordwest are likely to have witnessed a variety of industrial activity, associated both with general settlement activity but also no doubt with maritime activity. There is little indication that such industrial activity was ever very extensive however. One of the most recognisable elements of medieval industry comes from mills, of which several examples are known from within this area. Many of these mills made direct use of the waterway as their power source, either as tidal mills, such as the former mill on Pembroke's Mill Bridge, and the predecessor of Carew French Mill, or by using the many rivers and streams that feed the waterway. Coastal locations also often provide favourable conditions for windmills, and such sites are known near Dale, Hakin and Angle. Mills remained a common feature of many settlements until fairly recent times, and examples are known throughout the Haven from Dale in the west to Haverfordwest and Blackpool in the upper reaches of the Cleddau. Blackpool was also a site in active use during the early days of the industrial revolution. In 1635 an iron smelting works was built nearby within Canaston Woods, powered by charcoal from the local woods, which became an important place in the development of blast-furnace technology. Pig Iron was imported from the Forest of Dean, possibly via boats up the Eastern Cleddau.

The use of charcoal to power these sites was gradually replaced by coal during the 17th and 18th centuries. Coal was being excavated along the coal measures that passed through the upper Haven area, probably since the late medieval period, but until the 18th century this is likely to have been carried out on a small-scale seasonal basis by local farmers and farm labourers. Small coal pits in the Hook and Little Milford area are probably the earliest coal workings in the area, removing the coal where it appeared close to the surface but the convenience of having the waterway as an adjacent trade route meant that by 1700 coal had become the chief export from Pembrokeshire. As demand and technology increased throughout the 18th century so coal extraction in this area became more developed, organised and extensive.

Large collieries developed around Freystrop, Landshipping and Cresswell during the 18th century, joined by the extensive Hook colliery in the 19th century. The need to export larger quantities of coal lead to the expansion of existing quays and the development of new wharves and jetties on the waters edge. Sites such as Little Milford and Landshipping Ferry became busy ports, whilst new quays and jetties were established around Hook, Sprinkle Pill, Llangwm and Landshipping Quay. Cresswell Quay also developed as a coal processing plant and quay, sending coal down in small boats to Lawrenny Ferry, where it could be loaded onto larger boats for the coastal trade. The now extensive coal industry was attracting wealth and settlement to the area. Mine owners such as the Owen family were able to build impressive mansion houses, the remains of which can still be seen at Landshipping Quay. Scattered settlements of mine workers developed around the collieries at Hook and Freystrop, as well as more nucleated centres around the bustling quays at Landshipping Ferry and Quay and Cresswell Quay. Having the waterway so close to the mines was not always an advantage however, with flooding a constant

problem. At Garden Pit near Landshipping a disastrous flood in 1844 left 40 mine workers dead, and effectively spelt the end of the mine. Elsewhere work continued well into the 20th century, and by 1938 Hook Colliery alone was employing over 138 men. However, Nationalisation soon followed and the Pembrokeshire coalfields were declared uneconomic in 1947, spelling the end of coal mining in this area.

Small-scale metal mining is also recorded around the Haven. Copper is said to have been excavated on West Blockhouse point near Dale, and South Hook Point, during the 18th and early 19th century. In the upper reaches of the Eastern Cleddau pockets of iron ore were being excavated, mainly for use in the local blast furnace, during the 17th and 18th centuries. In 1793 an attempt was also made to mine silver near Slebech, although it is unlikely silver existed here. These mines probably made little use of the waterway however, remaining relatively small-scale and mainly for local sources.

The other major industry in the area during this period was quarrying, an industry often overlooked. The geology of the waterway meant that a variety of stone and ore was available for quarrying, from harder millstone grit and sandstone, to the bands of softer limestone and siltstones. Much of this stone would have been quarried as building stone from an early date, although it is difficult to positively identify early quarries. By the 18th century the use of burnt limestone as both agricultural fertiliser and as a component in mortar and render, at a time when agriculture, industry and settlement were developing quickly, meant a great increase in limestone quarrying. Bands of limestone run up the Pembroke and Carew rivers, as well as around Pembroke Dock, and along the upper reaches of the Eastern Cleddau through Millin Cross and Uzmaston. Quarries cropped up along these seams, along with numerous limekilns.

Quarrying along the Pembroke River was so extensive during the 18th century that Morris writes in 1748 'the navigation up this [Pembroke] river to Pembroke Town is much impeded by the rubbish of the limestone quarries being thrown into the river; which ought to be remedied, or the place will be stopped up in the process of time.' By the end of the 18th century the quarries at West Williamston had developed into the most extensive quarry site in the Haven, the remains of which are still clearly visible today. The stone was quarried for some distance back into the hillside, channels were cut through the marshland in front, and even the Cresswell and Carew rivers were canalised. This allowed barges to pull up to small docks erected in front of the quarried rock faces, allowing the stone to be loaded directly on to them and be shipped throughout the Haven. Similar quarries with direct access to river barges can be seen along Garron Pill, Llangwm Ferry Quarries, Cunnigar Quarries near Uzmaston and Catshole Quarries near Pembroke. The widespread distribution of limekilns along the coastline of the haven, often close to any available landing point, is indicative of the extensive local coastal trade in this limestone, with larger deposits finding their way along the Welsh coast and Severn Estuary areas.

Shipbuilding has long been another important industry throughout the Haven, more closely linked to the maritime heritage of the area. Small-scale shipbuilding has probably long been undertaken in many of the inlets and bays along the Haven, but during the 18th century major shipbuilding centres were being established within the Haven, such as Neyland in the mid 18th century, Milford Haven in the late 18th century and Pembroke Dock by the early 19th century. Shipbuilding at Pembroke Dock continued for over a century, building over 260 ships until the dockyards were closed in 1927. These major new ports attracted various other ancillary industries associated with growing settlements of the industrial era, such as iron forges, tanneries, sail lofts and so on. Growth continued with the arrival of the railways in the mid 19th century. Isambard Kingdom Brunel chose Neyland as the site of a

major railway terminus in 1852 which provided a major spur to the expansion of the town. In 1863 a line was added to Milford to help revive the town, and the following year the railway also arrived at Pembroke Dock, later extended to the docks.

The most dramatic industrialisation of the Haven has come in the later 20th century when the potential of the deep harbour for transporting major loads has been realised. Milford Haven provided the deep-water harbour enabling very large crude carriers (VLCC) to dock in the sheltered harbour and offload their crude oil to be refined and huge refineries opened up in the Haven in the late 1960s. The harbour continues to be used in this way today, dwarfing previous industrial activity in the Haven. In 1998 the former Gulf Oil Refinery at Waterston was acquired by Petroplus, a large midstream oil company engaged in refining crude oil, storage and wholesale marketing of oil products. Other refinery sites have been converted to Liquid Natural Gas storage.

Military Development

The importance of defending the Haven may be demonstrated as far back as the Iron Age with the variety of defended enclosures seen within the study area. What is not clear however is whether these sites clustered around the waterway in an attempt to defend the Haven or were making opportunistic use of the naturally defended promontories that are common around this coastline. The natural defensive capabilities of these sites were readily appreciated by the Anglo-Norman invaders, who re-used many of the sites for their castles, such as Pembroke and Castle Pill. During much of the medieval period the Haven continued provide defence, and was also used as a convenient mustering point for the invasion of Ireland in the 12th century. However, towards the end of the medieval period the focus began to shift from using the haven for defence, to actually defending the haven itself, and all that it represented in terms of safe harbours and landings that could be used by invading armies, as was so effectively demonstrated by Owain Glyndwr and Henry Tudor in the 15th century. The value of the harbour was appreciated by Thomas Cromwell in 1538 when he initiated the construction of two artillery blockhouses commanding the entrance to the Haven. Of these only remains of the east blockhouse are still visible above ground. This structure, which may not have been completed until 1580, was formerly 3-storeys high with a gun platform on the first floor. Subsequently military surveyors and lay people drew up plans for a more extensive and integrated system of fortification for the Haven, such as Paul Ive and George Owen in 1595, but none of these schemes were implemented.

Throughout the civil war in the 17th century the waterway played a vital role in the conflict in Pembrokeshire, re-supplying and moving troops, as well as providing lines of communication. Sites such as Pembroke and Haverfordwest castles, and possibly also Upton castle, were refortified and held at various points by both sides. Royalist forces also built a small fort at the entrance to Castle Pill (within a former Iron Age promontory fort), along with a gun fort at the head of the pill, in an attempt to establish a safe harbour in the pill and tip the balance of power. The fort was armed with '18 great ordnance' but ultimately this failed to work as the county eventually fell to the Parliamentarians, and Oliver Cromwell ordered the sleighting of both Pembroke and Haverfordwest castles to prevent them being used in future conflicts.

Proposals were again mooted throughout the 17th and 18th centuries for a co-ordinated system of defence throughout the Haven, but changes in economic and political climates, as well as the practicalities of effectively defending such a large area, meant these plans never came to fruition. A threat of French invasion during the Seven Years War in the mid 18th century lead to land being purchased in Paterchurch, Neyland and Llanion on which to build forts, but work had only just begun on the fort at Paterchurch when the threat of invasion passed and work was abandoned. In c.1760 the Admiralty had established shipbuilding docks in the pill adjacent to Neyland, which was defended by a small shoreline battery, now a scheduled ancient monument. The lack of a supply base for the fleet in this area was becoming a major concern by the end of the 18th century and this helped Hamilton to persuade the Navy Board to establish major dockyards at his newly created port of Milford Haven in 1797. These new docks were defended by batteries on either side of Milford Haven, each one consisting of barracks with seven guns. Only a few ships were built at these dockyards however before the docks were relocated to Paterchurch on the south side of the Haven in 1812-14, later to be renamed Pembroke Dock. These docks not only worked on the naval fleet, but also became the home for large numbers of soldiers. Two companies of Royal Marine light infantry were initially sent to help defend the docks, with foot soldiers arriving in the 1840s. Initially the troops were billeted on St Patrick's Hill overlooking the docks, but as troop numbers increased more permanent camps were established in the 1850s, at Bush Camp and Llanion to the east, and Pennar to the west. Initially

the defence of the docks was provided by the Paterchurch fort, which was finally completed in c.1830 and garrisoned, although this was dismantled and replaced by the Pater Battery in the 1840s. In 1845 defensible barracks were built on the hill overlooking the docks and two Martello towers were also built in 1849-57. Serious thought was also being given to a more comprehensive system of forts to defend the entire Haven although work on these did not begin until the 1850s. A large area of land belonging to the Board of Ordnance is however marked on a tithe map of 1830 close to Neyland, which may have been another defended site.

The entrance to the Haven was defended by four forts built in the 1850s. West Blockhouse fort had six guns, Dale Point had nine guns, Thorn Island nine guns and Stack Rock had three guns. Following a report to Parliament in 1858 an extended system of forts were proposed to defend the Haven area from attack both by sea and land. Once again the scheme was not fully implemented but new forts were built at South Hook, Hubberston, Popton and Chapel Bay, with a fort added at Scoveston. The previous four forts were also modified to include new military technologies. Between 1859-65 South Hook fort was built to house 20 guns, and Hubberston and Popton were built to act in conjunction, designed to have a boom strung between them to prevent shipping. At Hubberston ditches protected a battery of 28 guns and barracks, with 31 guns at Popton. Scoveston was built in 1861-5 with 32 guns to protect the Haven from landward attacks. The small gun tower on Stack Rock and the battery on Thorn Island were both converted into forts in the 1860-70s, and finally Chapel Bay fort was built with a quick-firing battery in 1880, with the main fort built in 1890-1.

Rapidly advancing military technology however meant these forts were almost obsolete as soon as they were built. Chapel Bay was able to incorporate new technologies such as mass concrete into its design but by the end of the 19th century fixed defensive positions were becoming outmoded. Two large gun-batteries were added at the mouth of the waterway in 1901-4 to supplement and replace the existing forts. The Pater battery was dismantled in 1903 and the Martello towers were being used for storage by 1905.

This system of fortification may have quickly become outdated but a military presence within the Haven remained, becoming ever more intensive with the arrival of the 1st World War. With the development of larger battleships the Navy outgrew the facilities available at Pembroke Dock, but on nearby Pennar Point the Royal Engineers established an experimental submarine mining establishment, along with torpedo stores and barracks. Another extensive submarine mining establishment was also built close to Chapel Bay Fort. The threat of German U-boat activity in WWI lead to the establishment of airfields throughout the Haven area, operating both airships and aircraft. For example, an airfield was established at Carew Cheriton in 1915, known as RNAS Pembroke, and another Royal Naval airship station was built at Castle Pill. Gun and searchlight batteries, mine and oil depots, and observation and mine-watching posts were also set up around the coastline.

The cessation of hostilities only meant a temporary closure for many of these sites, with a far more intensive militarisation of the Haven occurring with the onset of the 2nd World War. By this time, in 1930, a Sunderland flying boat station was established in the corner of the former Royal Naval Dockyards at Pembroke Dock. Their large hangars still survive, and the wreck of one of these flying boats is the subject of an ongoing project aimed at salvaging the remarkably intact remains. The arrival of the RAF in Pembroke Dock revived a town that was beginning to suffer from the lack of Royal Naval work. Airfields became a common feature of the Milford Haven landscape during the 2nd World War. Sites such as Carew Cheriton were pressed into service once more, and new airfields such as Dale and Angle were constructed, both to defend the Haven and operate maritime patrols. A

variety of extensive military installations were established, including gun batteries, searchlight batteries, anti-aircraft batteries and armament depots amongst others. Alongside these major installations more discreet features were also built, such as pillboxes, machine-gun posts, tank traps and other features. These installations also brought with them large numbers of people and barracks, both temporary and more permanent sites were established all around the Haven. Barracks were extended around Pembroke Dock, new complexes built to service the airfields, and temporary huts were even established on Dale Meadows. Many of the 2nd World War sites were closed down after the war, although the onset of the Cold War ensured some remained in use until 1956 when coastal artillery in the British Army was abolished.

PORTS, QUAYS AND HARBOURS

Major Ports

Haverfordwest

Haverfordwest town lies at the head of the western Cleddau, at the meeting point of several historic overland routeways. The town has a variety of legends associated with its foundation, including possible Roman, Viking and even Saxon origins, although the physical evidence indicates it was founded in the early 12th century. A castle was sited on a rocky knoll overlooking the river, and a small settlement was established around it, bolstered by Flemish settlers in the region. Access to the waterway played a vital role in the establishment of these Norman castle boroughs, allowing access to supply and communication routes. Strong trade routes were also established along the waterway during the medieval period and Haverfordwest soon became a thriving town, the largest in the area.

The medieval quays and docks are likely to have been established along the appropriately named Quay Street. By the late medieval period the town was taking the bulk of the trade on the waterway, and also engaging in international trade, with cargoes from Gascony and Portugal recorded. As well as the quayside facilities warehouses, workshops, mills and various other buildings would have been built to facilitate the maritime trade. By the 15th century it had become the county town and suburbs developed across the river to the east. The continuing importance of the quay is illustrated in 1616 when every burgess of the town was required to provide a days labour for its repair and in 1748 Buck's print of Haverfordwest shows a variety of sea-going vessels and river barges still calling at the town quays and warehouses. Riverside activity also probably extended beyond the quays to the north of Picton Bridge, and a dock was created on the eastern bank between Picton Bridge and the Old Bridge. Maritime activity went into decline from the late 18th century, with the establishment of major new ports in the lower Haven and the gradual silting up of the upper reaches of the Cleddau. Sea trading dwindled, eventually ceasing altogether in the 1930s.

Today maritime activity in Haverfordwest is minimal, although slipways do still operate from the quayside. Much of the waterfront has been redeveloped and no medieval waterfront elements have been identified, although some of the old warehouses do survive and former quaysides and waterfront structures may have been buried beneath later development.

Pembroke

The ridge upon which the core of Pembroke now stands may have been an area of importance and settlement during the early medieval period, which is suggested by the fact the Norman invaders of the late 11th century made straight for this site and established a castle borough there. This became the centre of power for the new Norman lords of Pembrokeshire, with a strong castle and town defended to the north by the Pembroke River, and to the south by the now diminished Monkton Pill.

As with Haverfordwest access to the river allowed vital access to main routes of supply, communication and trade. A natural bay at the head of Monkton Pill would have provided convenient anchorage, albeit for rather shallow-draft vessels, and an early town charter indicates a quayside was set up against the main town bridge, presumably Mill Bridge. This was soon supplemented by a second quay on the south side of the castle near Monkton Bridge, but vessels could no doubt transfer cargo around the shoreline at the head of the pill. As the home to the earls of Pembroke and the administrative centre for the county the town would have attracted important river traffic during the medieval period, and continued to expand, although it was soon outstripped in size and as a trading centre by

Haverfordwest. By the end of the medieval period Pembroke was going into decline, administrative importance had passed to Haverfordwest and by the 16th century descriptions of Pembroke noted many ruined buildings and the poor condition of the town. Maritime traffic no doubt dwindled although a customs house was established in the town in the 16th century and exports and imports of corn, coal, cloth and various foodstuffs are still recorded through into the 18th century. By this time the limestone outcrops along the length of the Pembroke River were being extensively quarried and the river itself was becoming choked with the quarry detritus from, further constricting the passage of vessels up to Pembroke. Trade was still strong enough to warrant a rebuilding of the quay by the Mill Bridge in the early 19th century, and a new quay was built to serve an agricultural store on the north bank in the late 18th/early 19th century. Maritime trade however, eventually dwindled to a standstill by the 1960s.

No medieval waterfront features are now visible, although remains could still survive below later rebuilding and expansion. Little now remains of the quay on the south side of the castle. The northernmost quay is still visible though now derelict. The quay on the north side of the castle still operates as a launch site for recreational sailing.

Neyland

By the 18th century it is likely a small fishing settlement had grown up near the mouth of the Westfield/Barnlake Pill, then known as Kings Pill, a popular sheltered anchorage. The fishing industry expanded throughout the 18th century and between 1751 and 1782 Neyland had become one the largest herring ports in Wales. In the 1760s the Admiralty established a shipbuilding yard in the mouth of the pill, defended by a small fort on the headland. Only two warships were built, the Prince of Wales and the Milford, before the government withdrew their support and the yard was closed down, but private shipbuilding now took over and the small settlement began to grow. The main spur to settlement came in 1852 when I.K.Brunel chose Neyland to be the location for the SWR railway terminus, part of their London to Ireland route. To accommodate this an extensive new quayside area was built, along with wharves, slipways and a pier. By 1856 two steamers a week were leaving Neyland to sail to Waterford in Ireland and inns and hotels were built in the town to accommodate the travellers. The ferry service was eventually transferred to Fishguard in 1906 but Neyland continued to be an important fishing port until the 1920s when it became eclipsed by Milford Haven. During the 2nd World War the waterfront was strengthened with concrete to allow access for heavy vehicles and a hard was built as a parking area for Sunderland flying boats based over the water in Pembroke Dock.

Many of the old quaysides, slipways and waterfront features are still visible around Neyland although large areas of the railway terminus waterfront have been redeveloped and the large pier has now gone. Recreational boating has now taken over some of the slipways and landing stages, and a new marina has been built within the pill.

Milford Haven

By the mid 18th century there was a concern in the naval world about the lack of a large supply base and port in the area for the navy and coastal trade. When Sir William Hamilton inherited land in the area in 1782 he saw the opportunity to remedy this by establishing a new port around the mouth of Hubberston Pill. By this time a small settlement may have existed at Hakin on the west bank of the pill, presumably engaged in fishing and possible small-scale shipbuilding, but in 1790 Hamilton had obtained an Act of Parliament allowing him to establish a major new port here. In 1793 Nantucket whalers were attracted to the town, which became a centre of the whale (spermaceti) oil industry until the oil price crashed in 1819. The

Navy Board were also persuaded to establish naval dockyards in Hubberston Pill in 1797 and a period of major shipbuilding began, defended by two military batteries and their associated barracks. The naval dockyards did not last long however, they were transferred to a new purpose-built site at Paterchurch, later renamed Pembroke Dock. Private shipbuilding continued within Hubberston Pill, as well as along the foreshore at Hakin, Scotch Bay and within nearby Castle Pill, although not at levels sufficient enough to prevent the town stagnating. Several plans were proposed to revitalise the struggling town throughout the 19th century, including the building of Hakin and Black Bridges, but it was not until the 1880s when the Milford Docks were formed that the town began to recover. Initially new docks and quays were built in the mouth of Hubberston Pill for a transatlantic ferry service but the facilities lacked the capacity to cope. However, a large successful fishing fleet soon established itself in the docks, and the former passenger sheds were converted into a large fish market. For the next 60 years Milford Haven developed into the 4th ranking fishing port in the UK, landing a record 60,000 tons of fish in 1946. Various ancillary structures were built within the town, such as ice houses and smoke houses, and the fish market expanded. During this period Castle Pill became increasingly industrialised, eventually becoming the site of a major ship breakers yard in the 20th century. In the 1950s the fishing industry went into decline and although the arrival of major oil refineries in the vicinity ensured population levels continued to expand the level of waterfront activity in Milford Haven declined.

Part of the Milford Docks have since been converted into a popular marina but many of the other former maritime and industrial sites that grew up around the docks in the late 19th and early 20th century have been redeveloped. The remains of quaysides, slipways and piers are still visible along the foreshore of Scotch Bay and within Castle Pill.

Pembroke Dock

In 1812-14 the Admiralty decided to move their dockyard to a new site at Paterchurch on the south side of the waterway. Initially the shipbuilding here was undertaken in temporary buildings and in the open air, with the dockyard office within an old frigate that had been run aground. The dockyards gradually expanded and were rebuilt, with major expansion occurring in 1830-32, and again in 1844. The expanding docks attracted increasing numbers of workers from around the country but also large numbers of military personnel. Initially the defence of the dockyards was provided by a partially built fort and large numbers of Royal Marines who were set up in barracks around the town. Further forts, defensible barracks and Martello towers were established around the town to defend the important dockyards that had grown to become one the most important naval docks in the world. Civilian dockyards were also established Water Street, Front Street and Lower Meyrick Street during the 19th century. A stone pier had been built at Hobbs Point in 1832 and the Irish steam-packet service was transferred here. A substantial shipbuilding yard was also established to the south on Jacobs Pill in 1874, although it was closed 10 years later. A town had been laid out in a grid-iron fashion around the dockyards, and this began to expand east and south during the 19th century eventually covering the greater part of the headland.

By the early 20th century larger ship technology meant the facilities available at Pembroke Dock were becoming outdated, and the dockyards closed abruptly by 1927. A few years later the navy were replaced by the RAF as a Sunderland Flying Boat Station occupied part of the former dockyards. The arrival of the 2nd World War lead to an increased military presence in the Haven and especially Pembroke Dock. Since the 2nd World War Pembroke Dock is still used for leisure and commercial activities, including an Irish ferry terminal built in 1978-79, and many

of the traditional 19th and even 20th century dockyard buildings, town buildings and military buildings still stand.

Minor ports and quays or documented landing points

Angle Bay

Angle is a small planned settlement with 12th/13th century origins. The sloping beach at its eastern end gave easy access to Angle Bay and fishing and maritime trade became an important part of the medieval economy of Angle. This never developed into a major port however, possibly restricted by the shallow nature of the bay and the presence of the Oyster Stones in the mouth of the bay. Medieval beachside structures have not yet been identified. On the eastern side of the bay the beach may also have provided access to Rhoscrowther, an early medieval ecclesiastical site and small medieval settlement. The bay is still popular with recreational use, with some modern slipways and numerous moorings.

West Angle Bay

A small sandy bay flanked by rocky cliffs to the west of Angle. This bay provides some shelter from the main channel and easy access to the land but it may not have been intensively developed until the later post medieval period. By the 19th century a quarry had developed along the northern side of the bay, with its own small rock-cut harbour, and a brickworks developed along the beach edge in the early 20th century. Remains of the quarry and a nearby limekiln are still visible, but a carpark now occupies the site of the brickworks, suggesting current recreational use of the bay.

Martin's Haven, Pwllchrochan

A muddy bay at the head of a small valley, flanked by hard cliffs and fronted by extensive intertidal mud flats. The mud flats and build-up of saltmarsh within the bay have been identified as of possible palaeo-environmental importance, the bay itself would have provided easy and convenient access to the waterway for a long time. The church of Pwllcrochan lying further up the valley would have been surrounded by a hamlet or village during the medieval and much of the post medieval period, and the bay would have provided the nearest convenient harbour. By the 19th century maps show simple harbour structures within the bay. Little obvious remains of this harbour within the bay, although mooring posts indicate use of the bay until fairly recently.

Lawrenny

Lawrenny itself is a small village with probable medieval origins, and nearby Lawrenny Quay is likely to have been a quayside area from a similar medieval date. A long established ferry operated from this site across to Jenkins Point, Roose and Cosheston. By the 18th century the facilities here were expanded to cope with boats transporting coal and limestone from the quarries and mines of the upper Cleddau area, often reloading onto larger coastal and sea-faring vessels at Lawrenny Quay. This industrial traffic declined during the 20th century but the ferry continued to operate and the quay continued to provide local shipping facilities. During the 2nd World War a seaplane training squadron established facilities at Lawrenny Quay, building a hangar, hardstandings, slipways and a wooden jetty. Much of the quayside area, hardstandings and slipways are now used by the popular yacht club, although other features have since disappeared.

Cresswell Quay

Situated on the upper reaches of the Cresswell River, a coal processing plants and quayside were established here by the mid 18th century as a shipping point for the expanding coal industry in this area. Eventually three quays were built by the 19th century and the site became a busy shipping point. Due to the depth of the water at this point barges would often transport the coal as far as Lawrenny Quay to be reloaded onto larger vessels. A small settlement grew up around the coal processing plant. The coal industry began to decline in the 20th century, which

combined with a gradual silting up of the river meant operations here eventually ceased although the small settlement remained. The stone quays are still visible although many are now dilapidated and gradually eroding.

Dale

A medieval village with possible 13th century origins, that has long had strong maritime connections. The vale within which the village sits opens out onto a gently sloping gravel beach, ideal for drawing boats up. Fishing and maritime trade was a major part of the medieval economy. By the 16th century Owen indicates the deep water off the bay was a popular anchorage and Dale Bay itself was providing 'great reciepte'. During the 17th century it was one of the largest sea trading villages in Pembrokeshire, notably in ale. Declined during the 18th century but census records indicate fishing and trade continued.

Records indicate the village had a pier in the 18th century, but earlier mooring posts and slipways are also likely. Current structures include a pontoon, slipway and mooring posts and this is now one of the most popular sailing and boating centres on the waterway, often used as overnight anchorage for yachts travelling the coast. There is also a boat yard and yacht club in the village.

Crabhall to Musslewick

A wide sandy bay, fed by a tidal pill. Cliffs surround the entrance, but give way to more gradual, though still steep, slopes. Much of the bay is now backed by intertidal wetlands and marsh. It lies close to the medieval village of Dale, whilst Crabhall Farm may also have medieval origins and Musslewick to the east, consisting of a few houses, clusters on the cliff edge over looking a short beach. There are currently no major structures, other than a short slipway on the western side associated with some disused limekilns.

George Owen described the area from 'Crabhole House and St Ismaels point' as good landing, and this is also one of the possible sites of Henry Tudor's landing, as Rhys ap Thomas is said to have hid under Mullock Bridge at the head of the pill to escape from Henry. The fact that Crabhole is now separated from the beach by marshlands may suggest there has been a build up of marsh and sand over more recent times resulting in the little use of the bay today.

Sand and marsh build-up may preserve earlier structures, as well as provide important arch-botanical remains, but the lack of a major settlement on the bay may suggest it was likely to be used as only an occasional beaching point.

Sandy Haven

A wide sandy beach, with outcrops of rock, sloping gently into the waterway. The bay is backed by a long pill which dries out at low water, with saltmarsh forming at the entrance. To the rear of the bay, at the entrance to the pill, a narrow road leads directly from the shore (and caravan park) to Herbrandston. Opposite, on the western side a road leads from a disused quay on the shore to St Ishmaels, both villages with medieval origins. The small hamlet of Sandy Haven, also with medieval origins, lies around the disused quay and is likely to have been the main mooring point for boats landing at the bay. A short ferry previously operated across the pill from Sandy Haven, although access is now provided by stepping stones. This is another possible landing place for Henry Tudor, but the exposure of the beach to the waves may mean it was not heavily used. Limekilns and wrecks further up the pill indicate traffic also travelled further inland.

A small area of moorings still exist at Sandy Haven and the bay is still popular with recreational boating.

Gelliswick Bay
A sandy bay flanked by rocky cliffs, opening out from a small stream valley. In the late 16th century Owen described the bay as having fairly good landing at half tide but otherwise there is little obvious indication of historical use. Small slipways are shown on the eastern side of the bay on early maps, possibly associated with the 19th century fort overlooking the bay, but the bay may not have seen much use until the town was established in the late 18th century, even then it was probably not until it expanded in the later 19th century that this bay was particularly used.

Today the bay provides one of the main accesses to the waterway from the town of Milford Haven and is heavily used. A yacht club is located on its edge, and a public slipway also runs from the eastern side. The bay is apparently popular for swimming and is occasionally also used as short-term anchoring for visiting boats. Occasional erosion of the sand has revealed some peat exposures which could be of palaeo-environmental significance.

Newton Noyes
The waterfront at Newton Noyes may have seen some beaching activity during the past but this is unlikely to be significantly more than is the case for much of the shoreline within the Haven. In 1872 Newton Noyes pier was opened to allow the loading and unloading of larger boats that could anchor in the deeper water. Initially a tramline connected the pier to industrial and maritime sites within Milford Haven but industry also developed at the pier, such as an oil and manure works. During the 2nd world war the area around the pier became a naval base used in the construction of mines, but also used by the US Navy. The disused pier still stands, along with a variety of derelict military and industrial buildings behind.

Llanstadwell/Hazelbeach
Llanstadwell may have medieval origins, and both Llanstadwell and Hazelbeach settlements had been established by the early post medieval. The beach in front, although now mostly extensive mudflats, would have provided a good landing point, while Owen mentions the deep water off Llanstadwell as a good anchorage by Owen. Apparently by the 17th century this stretch of coastline, from Wear Point through to Neyland Point, was busy with small ships transferring cargoes of grain, coal, culm and limestone. A stone quay and pier was built on the beach in front of Hazelbeach by the 19th century, allowing ships to transfer their cargo and also used as a local ferry point. The local Rouse family also operated a small fleet of ships from Hazelbeach. A small quayside was built in Llanstadwell and a shingle spit at Castle Lake provided sheltered mooring. Castle Lake is still used for mooring small boats and a slipway and jetty still operate at Hazelbeach, extending from the remains of the former quayside.

Burton Ferry
A small settlement clustered on the waterfront. This is the site of a local cross-river ferry point to Pembroke Ferry amongst others that has operated since the medieval period. No medieval elements to the waterfront have been identified, but boats may have just pulled up on the beach in front. In the mid 19th century a small shipyard had been established by the Jolly Sailor pub, and the documented presence of a saw pit and limekiln indicate maritime activity other than the ferry. In the late 19th or early 20th century Trinity Wharf was established at Burton Ferry with a pier extending into the water, and a range of larger buildings behind. The pier is now disused but a landing stage has been established nearby.

Llangwm/Black Tar
Llangwm is a late medieval village with a strong fishing tradition. The village surrounds Llangwm Pill, a small tidal inlet that consists mainly of mud flats. It is unclear how well used this pill would have been for landing small craft as much of

the maritime activity associated with Llangwm is undertaken from nearby Black Tar, and has been since at least the 18th century. Although now only connected by a path 19th century maps show a road connecting the village to a substantial slipway extending across the mud at Black Tar point, and Bowens map of 1729 mentions 'Black Tar Key' in this area. The name may also suggest this quay and slipway was involved in the early coal mining exports prevalent in this area. Maritime activity in Llangwm has declined in the later 20th century, and little now remains of the original slipway. A small modern slipway has been built further to the north.

Sprinkle Pill

There is little evidence of extensive use of this pill until the 18th and 19th centuries. The expansion of the coal mining industry in this area during this period lead to several quayside areas being set up in Sprinkle Pill which became one of the main coal exporting points in this area. The Nash and Sprinkle collieries developed in the 18th and early 19th centuries to the south and south-west and a quay was built on the south side near the mouth of the pill. A roadway also connected the quay to Llangwm, which may even suggest the quay had earlier origins. The extensive Hook Colliery developed to the west during the 19th century and a larger quay was established on the north side of the pill. At least two further pills were established on the banks of the pill during the 19th century to service smaller collieries in the area. Coal mining continued into the mid 20th century until the Pembrokeshire coal mines were closed down in the late 1940s.

Hook & Underwood

As with Sprinkle Pill the expansion of the coal mining industry in the area around Hook during the 18th and 19th century lead to a demand for convenient shipping points. Two quays were built over the mud flats into the deeper water of the Western Cleddau to the north of Hook Colliery. The Ordnance Survey drawings of 1810 indicate Hook Quay was already in place by that time, and this developed throughout the 19th century connected to the main colliery via several tramways. At Underwood to the east a 2nd quay (Lower Hook Quay) had been built by the time the tithe map was created in 1841, although this appears to have been a simpler affair. By the later 19th century this site is shown simply as a revetted area of mooring posts. Coal mining continued at Hook Colliery well into the 20th century but after Nationalisation the Pembrokeshire coalfields were declared uneconomic and closed down in 1947. Remains of these quays can still be seen although they are now little used.

Little Milford

Little Milford consists of a small hamlet lying at the mouth of the Red Water stream. During the earlier post medieval period this was the site of a minor shipping point, and appears to be marked as such on Bowens map of 1729. It is not clear what manner of waterfront structures existed here at that time but during the 18th and 19th century the site was expanded and enlarged to cope with demands of the local coal mining industry. Coal may have been shipped from here from an early date but with the establishment of nearby Freystrop and Coffin Collieries in the 18th century a new stone-built quay was built jutting out into the mud flats, carrying a tramline that connected to the two collieries. Coffin colliery may have closed during the 19th century but Freystrop continued. Eventually the Pembrokeshire coalfields were declared uneconomic in the 1940s and coal mining ceased. Little Milford subsequently returned to small-scale maritime activity and woodland returned to cover much of the area. The quay was abandoned although remains are still visible.

Landshipping

The village of Landshipping may have medieval origins as a local ferry crossing, and indeed the small settlement on the edge of the Eastern Cleddau was known as

Landshipping Ferry. This ferry crossing is marked on maps of 1729 and 1744 but by this time coal mining had taken off in this area and it is likely any quayside structures would have been enlarged to cope with the increasing river traffic exporting the coal. By the late 19th century an extensive stone quayside had been built, overlooked by a large mansion house built by the Owen family, one of the prominent mine-owning families. Coal mining in this area had begun to decline by the late 19th century, eventually closing down throughout Pembrokeshire in 1947. This area continued to be used however as a local ferry and shipping point, although the quay itself has gradually deteriorated.

Landshipping Quay
An extensive quayside and small settlement that developed at the mouth of a stream by the early 19th century. A bridge was built across the stream and a long stone-built quayside was laid out to the south, fed by trackways and tramways from the numerous local collieries. To the north lay offices and buildings associated with the coal mines and quays. The quay provided one of the main shipping points for the Garden Pit colliery which closed down after a disastrous flood in 1844. Following this coal mining in the area began to decline until all the pits were finally closed down by the 1940s.

The quay itself is still visible but disused, however boats still draw up and moor on the mud banks in front of the bridge and settlement here.

Pembroke Ferry
A small settlement that has developed around a ferry point with medieval origins. The exact location and extent of the medieval ferry point is not clear but is shown in its current location by the early 18th century at least. Early detailed Ordnance Survey maps indicate the waterfront consisted of relatively simple structures, with the main road simply opening out onto the shingle foreshore, presumably the ferry would have drawn up on this beach. A small dock is shown on the beach on the 1881 OS map, whether this was part of the ferry service or part of a small shipyard is unclear. With the establishment of Pembroke Dock in the early 19th century population levels in the area increased and the small settlement around the ferry point no doubt expanded.

The ferry continued to operate until it was rendered obsolete with the opening of the Cleddau Bridge in 1975. The foreshore is now used for mooring the occasional small boat.

Bentlass
A small settlement fronting the Pembroke River. Bowens map of 1729 marks a single dwelling called 'Pontlas' at this point but by the later 18th century it is likely a small settlement had developed. Small-scale shipbuilding was apparently underway at this site by the late 18th century and the Bentlass Ferry was in operation by the mid 19th century, connecting with the Pennar Ridge on the opposite bank. Specific shipbuilding structures are unclear but the ferry appears to have operated from a simple slipway, drawing up on the muddy foreshore.
The development of intertidal saltmarsh and mud flats probably now restricts maritime access although a slipway does still exist.

West Williamston
By the end of the 18th century the quarries at West Williamston had developed into the most extensive quarry site in the Haven, the remains of which are still clearly visible today. The stone was quarried for some distance back into the hillside, channels were cut through the marshland in front, and even the Cresswell and Carew rivers were canalised. This allowed barges to pull up to small docks erected in front of the quarried rock faces, allowing the stone to be loaded directly on to

them and be shipped throughout the Haven. The series of tidal canals are still visible with numerous traces of associated features.

Further possible landing areas

Cosheston Bridge
Carew Castle
Llangwm Pill
Llangwm Ferry, Coedcanlas
Boulston Manor
Infilled inlet below Haverfordwest Priory
Blackpool Mill
Benton Castle
Roose Ferry
Black Hill
Garron Pill
Upton Castle
Whalecoomb Farm
Waterloo, Cosheston Pill
Bullwell Bay
Monk Haven
Slebech Park
Wear Point

MARITIME AND ASSOCIATED ARCHAEOLOGICAL POTENTIAL

Archaeological Potential

In addition to the known archaeological and historic landscape evidence previously set out there is further buried or otherwise unnoted evidence which still remains to be identified, revealed, recorded, protected, promoted, etc. Although it can be impossible to be certain of what this comprises, and where it lies, there is much that can be done to gauge the potential of any area for the survival of important archaeological or otherwise unsuspected historic environment remains. Using the information and data which has been collected as part of the research and digital recording for this study it has been possible to build up a picture of the potential for historic maritime remains within the study area.

The now famous example of a major maritime archaeological discovery, which happened unexpectedly, was the Newport Ship. In the summer of 2002 the well preserved remains of a mediaeval ship were discovered during excavation works for a new Arts Centre on the banks of the River Usk in central Newport. It was in an excellent state of preservation and is the most complete example of a ship of the fifteenth century surviving in Northern Europe. Despite the archaeological potential of the area having been flagged up by the archaeological curator the importance of the surviving archaeological evidence was not fully appreciated prior to development commencing. The development site lay on the western bank of the tidal River Usk close to the original harbour and castle of the town. The ship lay with its bow to north (upstream).

One of the principal aims of this study is therefore to ensure that such areas of potential, which lie within and in areas associated with the Milford Haven Waterway, are recognisable and definable.

Sub-marine Potential

The drowning of the river valley took place during the period of climatic amelioration following the last ice age. Sea levels were rising from c.15,000 BC and in c.6,400BC Britain's land mass was severed from the continent. Prior to c. 4,000BC areas of this now submerged landscape was dry land. Where that land surface survives there is potential for Palaeolithic and Mesolithic archaeology to have accumulated in the terrestrial, fluvial or estuarine deposits of the time which now survive beneath the waterway.

Submarine archaeological deposits from later periods are largely excluded from the waterway, with the obvious exception of wrecks, which may date at their earliest to the late Mesolithic, Neolithic and Bronze Age. Work undertaken in a small study area between Angle Bay and the Esso jetties in 2004 (Bates et al 2004) identified the survival of submarine deposits which had the potential to include terrestrial archaeological evidence. Similarly geotechnical surveys elsewhere (Maloney & Vail 2002) also indicate the survival of deposits below water that could be of archaeological significance. Deposits of a similar character are recorded in a series of boreholes undertaken within the waterway. Bathymetric and side scan surveys of areas of the Haven also show that submarine deposits exist which overly bedrock and cover large areas.

A large number of ships have been recorded as sinking within the Haven, although a much smaller number of wrecks have been positively identified. Many sites may no longer survive to any significant degree but there is a great deal of potential for more wreck sites to be discovered within the Haven.

Waterway Potential

An attempt has been made to digitally map these areas of submarine archaeological potential. A total of 75 areas have been defined and the relevant archaeological issues identified for each area. Many of these areas share similar characteristics and can be combined into 13 different 'Area Types'. See table 1.

Area Type	Level of Potential	Area Nos. included	Description
Dredged Channel	Medium	1	As a dredged area much of the archaeologically interesting sediment would have been removed, but as the depth of the main channel is greater than the depth reached by the dredging then there is the potential for submerged archaeological features, such as wrecks, surviving within the channel.
Dredged Area	Low	2, 3, 5, 6, 7, 8	These area areas that have been dredged, likely to have removed both sediment and archaeological features, and even in some cases the underlying rock, so there is very little archaeological potential in these areas.
Harbour	High-Medium	4	Milford Haven harbour has witnessed a great deal of activity that would be of great archaeological interest, this however is tempered by the fact the harbour itself was dredged in the late 20th/early 21st century which may have removed this potential.
Main Channel	Medium	9, 19, 20, 29, 36, 48, 56, 62, 72	The main channel has been a waterway since the end of the last Ice Age and therefore will not have the potential for submerged Palaeolithic/Mesolithic settlement sites that exists in areas of submerged sediment. It does however have the potential both for washed in, and therefore displaced, archaeological sediment and features, and also wreck sites.
Rock Exposure	Medium	10, 11, 14, 15, 22	Rock exposure indicates there is very little in the way of sediment with archaeological potential, although pockets may survive. There is also the ever present possibility of wreck sites.
Slight Sediment/Deep Area	Low	12, 17, 28, 41	Areas generally found at the mouth of the haven. Sediment cover may be slight but also, although out of the main channel, the depth of these areas indicate they are likely to have been submerged from the end of the last Ice Age, therefore prior to human arrival and settlement in the area.
Major Bay/Landing Point	High	13, 18, 24, 26, 27, 32, 45	Areas where concentrated maritime activity is likely, along with the potential for archaeologically interesting sediment.
Sediment	High	16, 30, 35, 40, 43, 44, 51, 61, 64	Areas of submerged sediment that may contain undisturbed remnants of Palaeolithic or Mesolithic settlement and activity sites.
Possible Sediment	Medium	21, 23, 37, 42. 46, 58, 60	Areas where there is insufficient evidence to determine the true levels of potentially interesting archaeological sediments, but survival is possible.
Bay	Medium	25	Bays are typically areas of heightened maritime activity, here however there is no clear evidence for this, as the bays themselves are backed with cliffs preventing easy access, and more suitable beaching points lie nearby.
Pill	High	31, 33, 47, 59, 71	Pills provide easy access for boats etc to get inland, and were often well used over long periods of time. The tidal nature of these pills also encouraged a variety of other activity, such as fish traps, river crossings, mills etc.
Rivers, mud & marsh	High	34, 38, 39, 52, 53, 54, 55, 65, 66, 67, 68, 69, 70, 73, 74, 75	More upriver coastal areas, consisting of muds and marshes and shallower sections of rivers. These areas hold a variety of deposits that will be of archaeo-botanical interest, as well as specific sites of known and suspected archaeological activity.
Slopes	Low	49, 50, 57, 63	Areas that lie outside the main channel, but underwater slopes are unlikely to have been suitable areas for sediment accumulation and archaeological activity. It is unlikely that wreck sites will have settled on slopes.

Table 1 – Areas of water based archaeological potential

Land-based Potential

Boreholes in the tidal salt marsh of the Pembroke River prior to the building of Pembroke Power Station revealed the survival of peat deposits at a depth of between 2.8 and 3.1m below the current land surface. Peat exposures have also been noted along the foreshore. This deposit can be up to 1m thick. It is likely that it was formed at a similar period and under similar conditions as the 'submerged forest' (Murphy & Allen 1998) that is noted around much of the Welsh coast. Elsewhere, artefacts from the Mesolithic to the Bronze Age have been discovered within and overlying this deposit. These peat deposits would have formed in shallow lagoons resulting from, and then subsequently immersed under, the rising sea levels. These lagoons would have provided a variety of resources exploited by Prehistoric groups. The anaerobic waterlogged environment provide ideal conditions for the survival of organic remains, not only offering potential for the preservation of organic artefacts, but palaeo-environmental evidence in a deposit that can be radio-carbon dated.

Other coastal deposits also have potential for palaeoenvironmental data. For example clays and muds exposed in a low cliff face at West Angle bay have been examined, revealing a pollen assemblage that was dominated by temperate forest taxa possibly from the Hoxnian interglacial. Airfall deposits have also been examined from Martins Haven and the Pembroke River area, examined alongside other deposits from South Wales, record a reddish-brown loam laid down in a cold arid climate after the late Devensian glacial maximum of c.30,000 – 10,000 years BP.

Tidal flats and reclaimed land examined elsewhere in Wales, most extensively on the Severn Levels, has uncovered artefacts and structures dating from the Neolithic through to the Roman period, highlighting the possibility of similar finds within the Haven area. Areas of marsh with active peat formations are likely to exist in many of the sub-estuary heads within Milford Haven, such as Martins Haven and along the south side of the Pembroke River.

Land Potential

In going through the study area looking at different areas of maritime archaeological potential 74 individual areas have been created. Many of these areas share similar characteristics and may possibly be combined into the 9 different 'Area Types', although these areas probably contain more unique characteristics than the 'waterway potential' areas.

In terms of maritime archaeological potential three basic and broad groups are suggested, namely High, Medium and Low. Unlike the waterway potential the land-based potential presented a more complex variety of issues making it difficult to confidently ascribe different degrees of potential. Essentially archaeological sites exist in all the areas, so it could be said the entire area is of High archaeological potential. This is made all the more confusing by the fact that this particular study has been looking solely at maritime sites or sites directly associated with the waterway so a complete picture of the archaeology has not been obtained.

The areas have tentatively been broken up into areas of High, Medium and Low potential. 'Low' is where maritime archaeological features, sites and deposits are unlikely to exist or survive, either because the area has been heavily developed, there are no known or suspected sites, or only minor sites, have been recorded in that area with new sites unlikely. 'Medium' is where maritime archaeological sites, features and deposits may survive but there may be little information about them, or they may be relatively minor sites. 'High' is where good maritime archaeology is known, or strongly suspected.

Area Type	Level of Potential	Area Nos. included	Description
Promontory	High-Low	1, 8, 12, 32, 51, 72, 73	Tend to be sites chosen for defensive sites, either Iron Age promontory forts of Palmerston forts, and often both. As a result the archaeological potential of these sites is often high. The one exception being the promontory of Sawdern Point, presenting a thin jutting promontory unsuitable for such sites and therefore unlikely to have the archaeology.
Coastal Cliffs/Plateau	High-Medium-Low	2, 4, 7, 15, 16, 19, 20, 30, 34, 66, 71	These areas present a varied mix, due mainly to the fact their cliff edges often separate them from easy access to the water, but provide prominent locations on which to site maritime sites like lighthouses etc. Their coastal location also means they contain areas with that are connection to maritime activity, but don't necessarily have to have direct access to the water, such as coastguard stations etc.
Historic Settlement	High	3, 6, 18, 24, 26, 28, 35, 36, 38, 40, 43, 46, 48, 52, 59, 65	These areas encompass known areas of historic settlements, or the historic cores of settlements that have later expanded. The term 'historic' here is taken to mean pre 20th century settlement, which can basically be separated into medieval settlements and 18th/early 19th century settlements.
Pills & River Valleys	High-Medium	5, 9, 17, 22, 29, 31, 58	These areas have almost exclusively seen a variety of archaeological activity. Geologically, pills, rivers and streams open out into the Haven providing bays, which are often the most suitable places for maritime activity, whilst also providing access inland for boats etc.
Inland Area	High-Medium	10, 37, 44, 62	Generally inland areas have been excluded from this study as they have little connection to the waterway, but these particular areas are included because they have a direct link, which is why they generally have high archaeological potential.
Modern Development	Low	11, 13, 21, 23, 25, 27	These areas encompass the intensive development characteristic of the later 20th and early 21st century. This includes both settlement expansion and the oil and gas refineries. Such intensive development often obscures, damages and removes the archaeology, hence the low archaeological potential.
Coastal Slopes	High-Medium	14, 33, 39, 45, 47, 49, 50, 53, 55, 57, 61, 63, 64, 68, 69, 74	Basically a mix of coastal areas, very similar to the Coastal Cliffs/Plateau, but the more gradual slope gives these areas easier access to the water and therefore tend to have more maritime links, although this is tempered by the fact they tend to occur further upriver.
Early Industrial Area	High	41, 42, 56, 67	These areas encompass areas where the dominant archaeology of the area is industrial activity, mainly of the 18th and 19th centuries, and either coal mining or limestone quarrying.
Floodplain	Medium	54, 60, 70	These areas are flat floodplains or reclaimed land that due to its nature means it is often unsuitable for heavy development but may have both environmental potential and have been reclaimed for specific reasons.

Table 2 - Areas of land based archaeological potential

THREATS

The recent and on-going development of The Haven is important not only for the economic regeneration of the county of Pembrokeshire, which has suffered from economic decline over the later part of the 20th century, but also for the rest of Wales and the UK. The Haven has been identified as an up and coming "powerhouse" of Wales. Following on from the Tudor mining and exportation of anthracite to the 20th century oil industry within the Haven the deep-water harbour now provides facilities for importing and distributing Liquid Natural Gas which is recognised as crucial to the future UK power supply. The gas supply has seen the development of a new generation of power stations and ancillary development, storage sites and connecting pipelines.

Specific threats to the archaeological resource

Dredging

The increased industrialisation of the Waterway during the later parts of the 20th century has posed one of the most direct threats to both the land, coastal and submarine archaeological deposits within the Haven. The arrival of large crude carriers to the oil refineries of the Haven required a wider channel to be dredged along the Haven. The depth of this dredged channel is unclear at present, but an engineering report of 1972 discusses the potential for dredging between 6.5 to 20m deep, removing thousands of cubic metres of rock. This channel is visible on the acoustic bathymetric survey, up to 350m wide in places. Further dredging is recorded in more recent years alongside the berthing jetties and main docks, as well as alongside the main channel to provide safe turning circles. Such dredging has an obvious impact, removing a great deal of the sub-surface deposits, although wreck sites may survive in the deeper natural channel below the level of the dredgers. The arrival of ever larger tankers in subsequent years will no doubt require regular re-dredging of the channel and possible further areas, removing more significant deposits with archaeological potential.

New quays and jetties, pipelines and under water cables

Increasing use of the waterway will result in changes to current quays and jetties as well as the potential development of new structures. The distribution of LNG and electricity from the proposed power stations has and will continue to require substantial infra structure construction. These types of activities all have the potential to damage and destroy areas of submerged land surfaces as well as wreck sites along with any associated archaeological remains. They will all also have land based elements the construction of which can be extremely destructive to the surviving remains of waterside structures.

Development

The strategic development plans for the area (Wales Spatial Plan and Pembrokeshire Joint Unitary Development Plan) identify the importance of economic growth to the area. The Wales Spatial Plan identifies the Haven as an important focus for future investment which will include support for energy generation related opportunities, for example bio fuel production as well as the current LNG developments and the development of gas-fired power stations.
Further residential development also continues to be required

Tourism

Further development of tourism and leisure is also idenified within the strategic plans as important while the need to protect and enhance the area's distinctive character is also recognised. The marina at Pembroke Dock is an example of the expanding maritime leisure industry. Increasing visitor numbers will result in increasing visitor pressure on the historic environment generally. Small scale but

potentially problematic damage can be caused through path erosion and other localised affect from vehicles, barbeques, horses etc potentially becoming serious in combination with other threats.

Neglect

Neglect is the biggest threat to many of the substantial military forts, docks, gun batteries and other structures. Maintenance of many of the these sites is vital to prevent decay and ruination. Vegetation growth obscuring or damaging important archaeological remains can also be a problem.

Climate change

Recent forecasts provide an increasingly disturbing picture of the impacts of climate change. Rising sea levels have been clearly documented and, combined with changing weather patterns appear to be resulting in increasing coastal erosion. Such erosion can both reveal previously unrecorded remains as well as destroying known sites and features. Sea level rise will also cause the flooding of low lying land, resulting in both erosion and decreasing accessibility of surviving historic environment evidence.

The human responses to global warming and climate change also have the potential to detrimentally impact on the historic environment. Examples include renewable energy such as wind turbines being placed within historic landscapes or the deep cultivation of agricultural land, in which buried archaeolgoical deposits survive, to grow biomass fuels. Coastal engineering to protect the current coast line or managed retreat can both have detrimental impacts.

Increased winter rainfall may result in flash floods and greater erosion, while human responses such as flood defences and water management features may directly impact on the historic environment. Hotter dryer summers may result in desiccation and increased fire risk, etc.

CONSERVATION AND MANAGEMENT OF THE IDENTIFIED HISTORIC ENVIRONMENT RESOURCE

This study, principally comprising information and data held within the GIS MapInfo tables accompanying this report, has been designed as a tool to assist archaeologists, planners, strategic decision makers, land managers and developers in understanding the maritime archaeological resource associated with Milford Haven Waterway and the issues and implications associated with proposed land-use changes.

The historic environment is an asset and an economic resource which can provide opportunities for present and future generations. It contributes to our sense of place and cultural identity. It enhances our quality of life and adds to regional and local distinctiveness. It is one of our most important social assets, linking people with places and forging community identity and cohesion.

However, the historic environment is a fragile resource. Once elements have been destroyed or altered they can seldom be recovered, and the character and quality of the whole is eroded easily by thoughtless actions. We have a duty to protect those historic assets that are valued and manage change in the wider historic environment sensitively and sustainably to retain what is significant and pass it on to future generations. The Welsh Historic Environment – Towards a Strategic Statement DRAFT, Produced by the Historic Environment Group, an advisory forum of the Welsh Assembly Government, states:-

> "The historic environment makes a significant contribution to the strategic agenda of the Welsh Assembly Government, as expressed in *One Wales* and *People, Places, Futures: The Wales Spatial Plan*. *One Wales* recognizes the geographical, social, linguistic and cultural diversity of Wales, which is embedded within the historic environment. Pride in history forms the bedrock of a strong and confident nation. Exploration of our environment promotes a healthy future; for example, in encouraging Walking to Health. *One Wales* makes reference to the need to draw upon our unique culture and history in the promotion of Wales and recognizes the role that this can play in creating a prosperous society. Pride in place and recognition of historic character foster living communities. Learning for life through the stimulus of the historic environment benefits from an understanding of our place in the world, 'looking to the past in order to deliver a better future for the people of Wales'. Heritage and cultural fabric are resources for regeneration, encouraging citizenship and the creation of a fair and just society. A sustainable environment can grow from managing and protecting historic assets. *One Wales* recognizes the need to 'celebrate and conserve Wales's outstanding heritage', to promote a sense of ownership and identity and to highlight those elements that give Wales a distinctive place in the world. In short, the historic environment lies at the core of our rich and diverse culture. The historic environment helps to deliver each of the guiding themes of the *Spatial Plan*. This recognizes our environment as a crucial asset, highlighting the benefits of Wales's high-quality landscapes and its 'wealth of archaeological sites and historic monuments' and asserting that valuing our environment must include safeguarding and enhancing the natural and the built heritage. It states that 'we need to maintain and support the distinctive character of the Welsh historic environment', as celebrating and respecting distinctiveness is 'central to promoting Wales to the world'. Building sustainable communities relies on attractive places to live and work; and the same attractiveness promotes a sustainable economy."

Users
It is hoped that a wide range of individuals and organisations will both have access to and an interest in using the results of this study. Two principal groups of users have been identified. Those who are actively involved in developing understanding of the Haven's historic environment and those with responsibility for its future management.

Potential users
The Regional Archaeological Curator – Planning Archaeologist
Specialist interest groups and individuals
Local interest groups and individuals
Cadw
RCAHMW
Welsh Assembly Government
Pembrokeshire County Council and Pembrokeshire Coast National Park Authority
Milford Haven Port Authority
Countryside Council for Wales
Environment Agency
Community Councils
Environmental Groups

Using the results of the study
This guidance largely relates to the buried archaeological resource, whether above or below water, though consideration also needs to be given to listed and unlisted buildings, urban and rural morphology and topography as well as the historic landscape features of this registered landscape of outstanding historic interest. All of these archaeological remains are a finite and non-renewable resource. They are vulnerable to land-use change and modern development and can, within a short space of time, be entirely destroyed by modern machinery and building methods.

Statutory Protection
All maritime sites, buildings and structures which are protected by legislation have been mapped within the GIS (Appendix 1) and include Scheduled Ancient Monuments (SAMs) and Listed Buildings of Special Architectural and Historic Interest (LBs). The designation consent procedures for works affecting SAMs are the responsibility of Cadw. While LBs are designated by Cadw the Local Planning Authorities administer the consent procedures for works affecting them.

Protection	**Current Legislation or Guidance**
Statutory protection	The Ancient Monuments and Archaeological Areas Act 1979, as amended by the National Heritage Act 1983
	The Town and Country Planning Act 1990.
	The Planning and Compensation Act 1991
	Statutory Instrument 1199, the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988.
	The General Development Procedure Order 1995.
Non Statutory Protection	Planning Policy Wales, March 2002
	Welsh Office Circular 60/96, *Planning and the Historic Environment: Archaeology*, December 1996.

	Welsh Office Circular 61/96, *Planning and the Historic Environment: Historic Buildings and Conservation Areas*, December 1996.

Changes proposed by the Draft Heritage Protection Bill

The current draft Heritage Bill (April 2008) proposes a single register for all heritage assets, bringing into line a variety of legislation regarding the historic environment. This will include marine assets, which lie below water, enabling for the first time a recognition in legislation of the continuity of the historic environment above and below water. The programme for the proposed legislation should result in reforms taking effect from 2010.

Registered Historic Landscape

The significance of others sites is acknowledged through national, regional and local recognition e.g. Registered Historic Landscapes. These landscapes are of recognised national importance and are recognised within Planning Policy Wales as needing to be taken into account in the preparation of local development plans. All of the study area falls within the Milford Haven Waterway Registered Landscape of Outstanding Historic Interest (Murphy & Ludlow 2002)

All of the registered historic landscapes in Wales are in the process of being analysed and characterised. Each landscape has been broken down into Historic Landscape Character Areas. These have been recognized through the study of the historical development and the identification of characteristic historic landscape features. This information is publicly available on the web site of Dyfed Archaeological Trust.

http://www.dyfedarchaeology.org.uk/HLC/milford/milfordhavenmap.htm

As well as the register of historic landscapes there is also a register of Historic Parks and Gardens (Cadw and ICOMOS UK, 2002). While none of the registered sites have specific maritime interest there are examples which fall within Milford Haven Waterway registered historic landscape.

Historic Environment Record

The regional Historic Environment Record (HER) is held and maintained by Dyfed Archaeological Trust and includes the most comprehensive source of information on archaeological sites and objects from within Carmarthenshire, Ceredigion and Pembrokeshire. It covers all periods of human development from traces of the earliest prehistoric activity to Second World War defensive structures and includes information from Cadw on Scheduled Ancient Monuments and Listed Buildings. As well as designated sites of recognised national importance it also includes details of regionally and locally important remains. As well as information on individual sites the HER contains information on past landscapes and information from previous archaeological work undertaken.

The Record is a complex system of information based upon a computer database and digital mapping. For each entry on the record we hold key information such as the type of site, its name, its location and the period it dates from. Most records have bibliographic references and a description. At present the database holds over 39,000 records, a figure increasing every day.

Management Information

Linked with the HER are series of GIS layers of information. Some include data taken directly from historical mapping while others contain the results of the interpretation of a variety of historical and archaeological sources. These are intended to provide a synthesis of available data. Of particular importance are the

two layers which explain archaeological potential "Land based potential" and "Water based potential". These are intended to provide an indication of the maritime archaeological issues within each defined area.

It will flag up at an early point in the planning process that there are historic environment assets which need to be considered and where appropriate properly integrated as part of proposals for cghange.

Management Decision Making
This understanding will need to be included as part of any statutory and non-statutory planning or management decision process. These should follow the best practice set out within the Terrestrial Planning Process. In Planning Policy Wales (2002) the Welsh Assembly Government set out their objectives for the conservation of the historic environment in Wales.

- preserve and enhance the historic environment, recognising its contribution to economic vitality and culture, civic pride and the quality of life, and its importance as a resource for future generations; and specifically to

- protect archaeological remains, which are a finite and non-renewable resource, part of the historical and cultural identity of Wales, and valuable both for their own sake and for their role in education, leisure and the economy, particularly tourism;

- ensure that the character of historic buildings is safeguarded from alterations, extensions or demolition that would compromise a building's special architectural and historic interest; and to

- ensure that conservation areas are protected and enhanced, while at the same time remaining alive and prosperous, avoiding unnecessarily detailed controls over businesses and householders.

These objectives are as relevant to offshore development as they are to terrestrial development and land-use change. The role of the Milford Haven Port Authority is clearly of major significance, as a public trust harbour and pilotage authority with local legislative powers provided by statute with responsibility for granting River Works Licenses.

Specific Historic Environment Consultation
This guidance does not replace the need for any strategic planning or decision making body to seek the professional heritage management advice of Dyfed Archaeological Trust – Heritage Management, the regional archaeological curator, along with other statutory consultees. Through the established mechanism of the statutory land-use planning process and other best practice, Dyfed Archaeological Trust – Heritage Management provides a comprehensive service available to all the identified bodies and organisations as well as to prospective developers and other interested organisations and individuals.

While some development will have little or no impact; others will have an archaeological dimension and may provide potential to protect and enhance the historic environment or a constraint to development or other proposed management.

The most important tool we possess to inform the conservation and preservation of the physical remains of our past is our accumulated knowledge of them. Records of these remains are held in the extensive databases of the regional Historic

Environment Records. On behalf of the Unitary Authorities in South-west Wales, Dyfed Archaeological Trust – Heritage Management maintains c.40,000 records of archaeological and historical interest. For Pembrokeshire these records have been formally adopted by resolution of Pembrokeshire County Council for the purposes of the Town and Country Planning (General Permitted Development) Order 1995. This legislation provides the rationale and context for deploying this important source of information in the statutory land-use planning processes.

In terms of archaeological development control the HER, together with the information brought together in this study, will be the key advisory sources for the protection of the historical and archaeological inheritance of the Haven.

Early consultation by developers in advance of drawing up detailed development proposals is best practice. Developers should discuss their preliminary plans with the relevant bodies, organisations and authorities and Dyfed Archaeological Trust – Heritage Management as the regional archaeological adviser. A first step will be to consult the HER, which will provide information about the locations where archaeological remains are known or thought likely to exist. Professional archaeological staff in Dyfed Archaeological Trust are trained and experienced in the interrogation of these records and accordingly can provide appropriate interpretation and advice.

Acknowledgements
The author would like to thank Nikki Cooke, Louise Austin, Marion Page, Polly Groom and Charles Hill for their help in the management and preparation of this report. Thanks are also due to a variety of interested parties and key stakeholders for providing information, time and knowledge, in particular Mark Andrews of the Milford Haven Port Authority, Ron Watts and John Evans of the Pembroke Dock Museums Trust, George and Emma Geear of Chapel Bay Fort, Nigel Nayling and Martin Bates of Lampeter University, Mark Burton of CCW and David James of the West Wales Maritime Heritage Society amongst many others.

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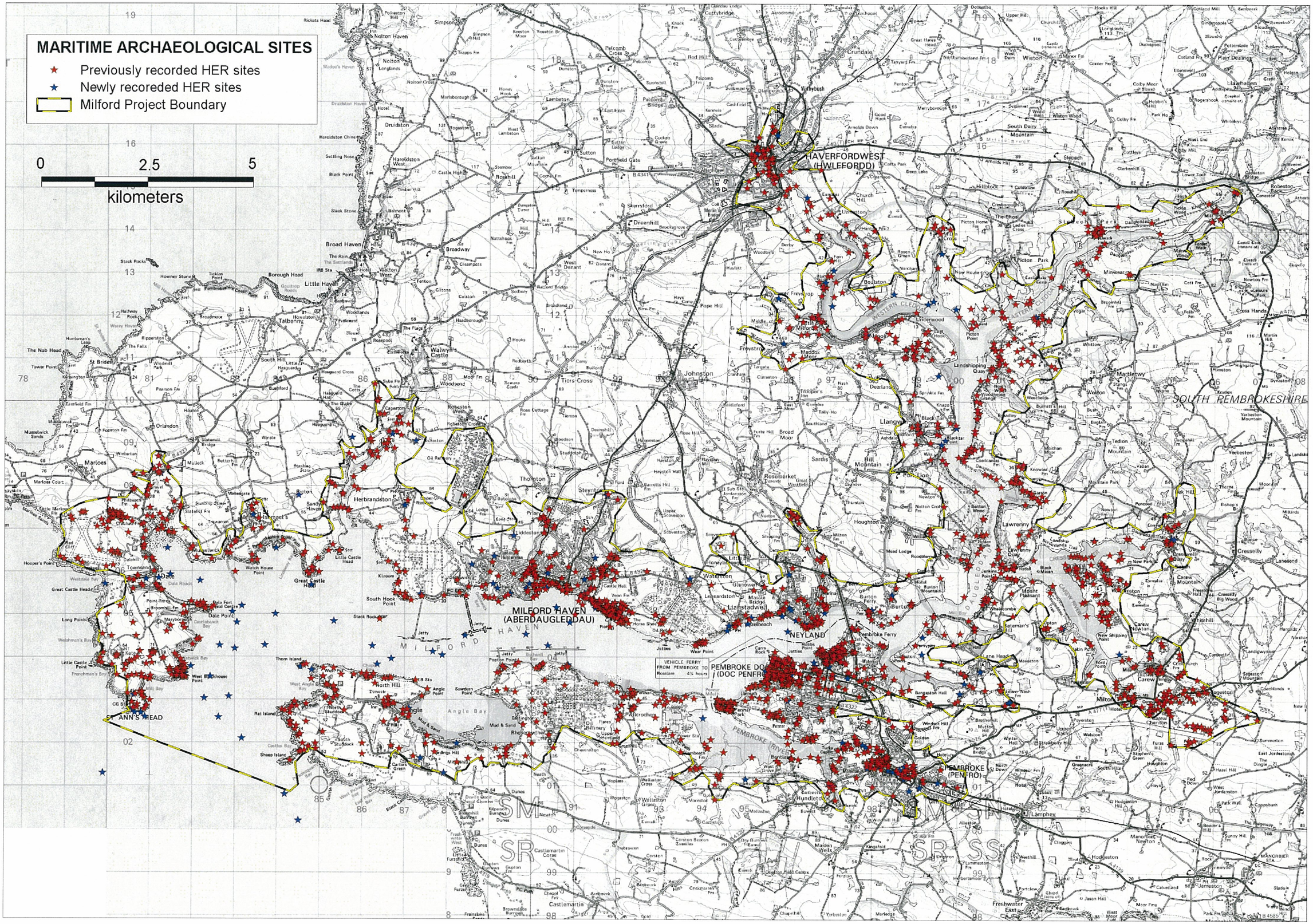
MAPS

Map 1 Historic Environment Record

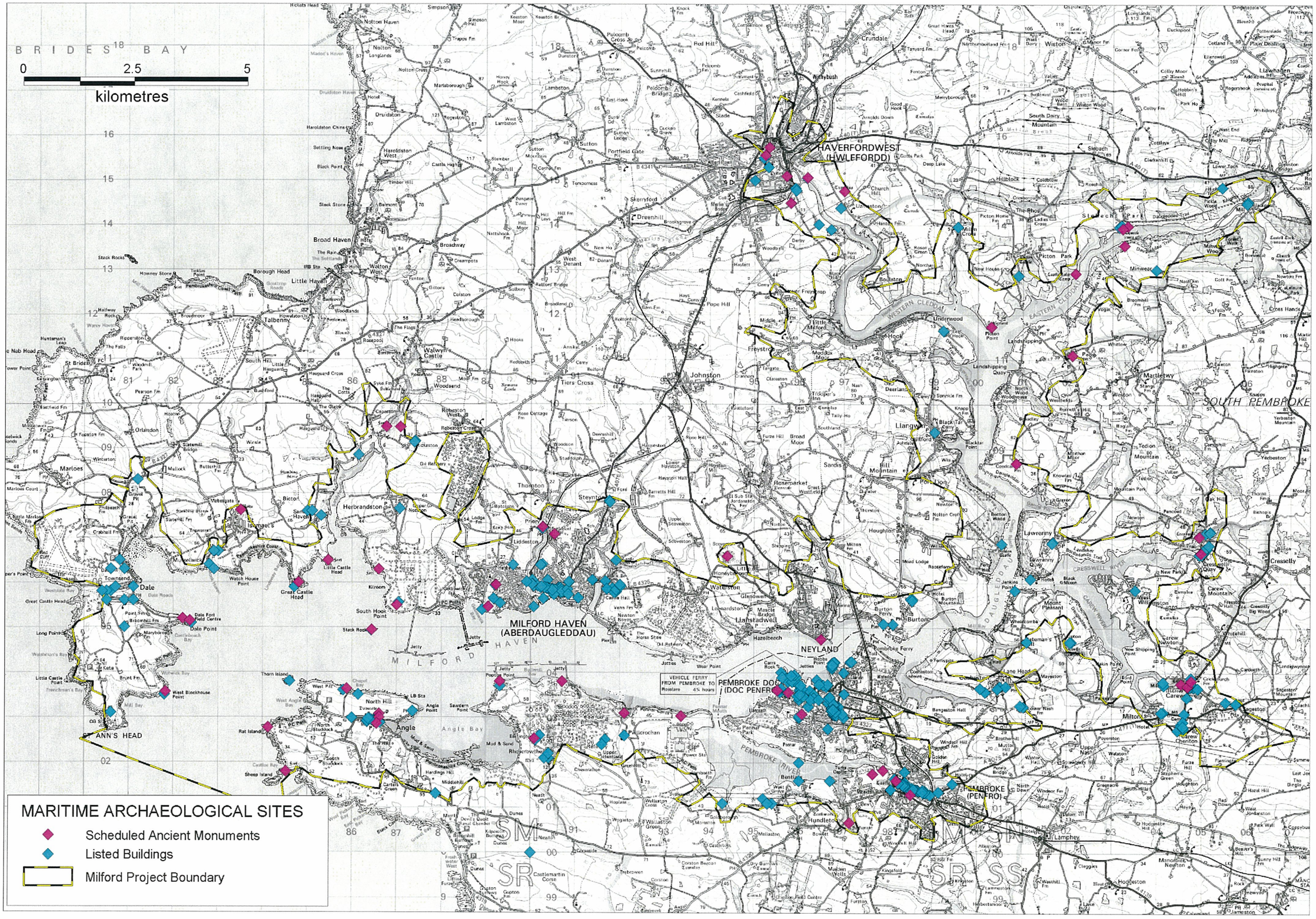
Map 2 Scheduled Ancient Monuments and Listed Buildings

Map 3 Ports Quays and Harbours, Military and Industrial Sites

Map 4 Areas of Archaeological Potential



Map 1 Historic Environment Record



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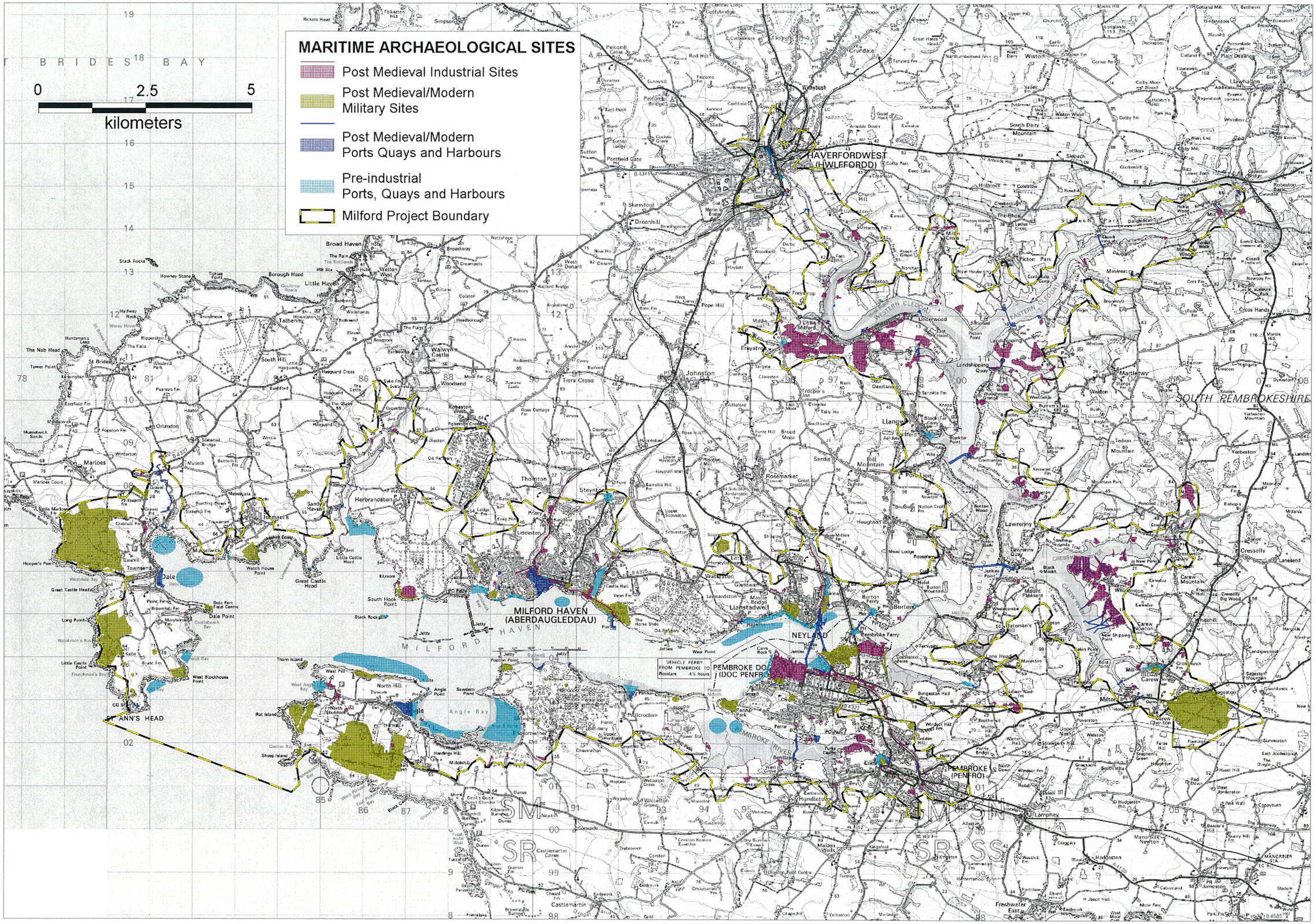
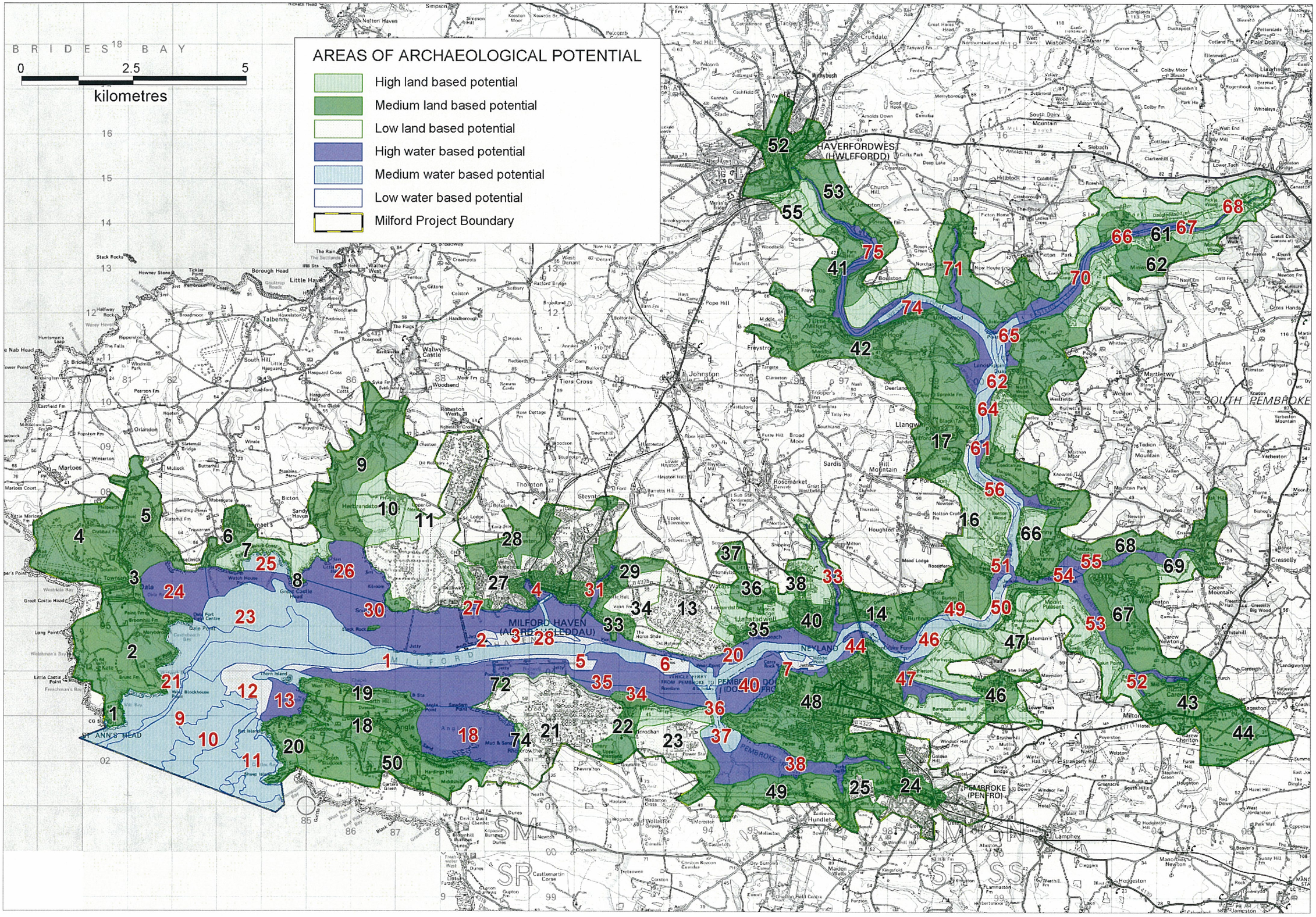


Map 3 Ports Quays and Harbours, Military and Industrial Sites



Map 4 Areas of Archaeological Potential

APPENDIX 1

Mapinfo tables

The following specific Mapinfo tables have been created:

A: HER sites
Final HER sites.tab

This is individual point data for HER records in the Waterway area, using the standard table structure for sites within the HER. The area chosen to select the sites corresponds with the study area and has been further refined to exclude those sites that do not have a specific link with the use of the waterway.

These sites can be broken up into their recorded time periods, from Palaeolithic through to Modern, but also include general periods such as Prehistoric, undated and multi-dated sites. Few of these sites have been looked at individually or verified, so their accuracy varies. However, community projects running through PLANED offer the chance for a rapid field and condition survey of selected sites, with this information fed back into the HER, and thus onto the GIS mapping. These projects could be pursued in the future.

B: Wrecks
Milford Haven Wrecks.tab

A table of point data attempting to show the known, approximate and general positions of ships lost within the Milford Haven area. These sites are colour-coded red, yellow and grey. Red sites are where wrecks are known to lie on the seabed, although some may be spread over a large area or are recorded only from relatively small finds. The condition of these sites have not been ascertained.

Yellow sites are approximate locations of wreck sites, mainly based on the approximate position of where the boats sank. The location of these wrecks on the seabed has not been ascertained, and could vary significantly from the locations given in this table.

Grey sites are records of boats that have been recorded as sinking in the general Milford Haven area. It is not clear if any of these sites actually lie within the channel or further out to sea.

This tables records both physical remains, reported wrecks, sites of wrecks from which the boats may now have been removed (for example the site where the Sea Empress ran aground but was later re-floated and towed away) and find spots recorded by divers.

The table includes standard data, including the name and date of the wreck, if known, brief descriptions, and the sources used to compile the information. Much of this data has come from work undertaken by the RCAHMW. There are some RCAHMW sites that have not yet been accurately located within the study area. These sites are represented by green dots and locating these sites is an ongoing process.

C: Designated Sites
Listed mhaven.tab; SAM points mhaven.tab; SAM polygons mhaven.tab

'Listed mhaven' includes point data for listed buildings recorded by Cadw within the study area. This is taken from the Cadw digital data.

'SAM points mhaven' includes point data showing the Scheduled Ancient Monuments within the study area. Taken from the Cadw digitial data, the 'SAM polygons mhaven' table includes the areas of the SAM also taken from the Cadw digital data, although this appears to exclude a few sites.

D: *Archaeological Investigations*
Events mhaven.tab; HLCevent.tab

The 'Events mhaven.tab' table includes polygon, line and point data recording the areas of archaeological investigation within the study area, taken from Cambria Archaeology's events layer. These investigations cover a variety of archaeological, or semi-archaeological investigations including excavations, watching briefs, desk-based assessments, topographic surveys, geophysical surveys, boreholes, building recording and photographic records. This table includes only those archaeological investigations for which Cambria Archaeology holds sufficient information on, therefore some archaeological work undertaken prior to the c1990's for which there is no published report may not be included. The table holds information about the type of investigation, who undertook the work and when, as well as other standard fields and brief notes about the findings of the work.

The 'HLCevent.tab' table contains the polygon showing the area of the Historic Landscape Characterisation of the Milford Haven, in the same format as the other table, but separated purely due to the fact it covers the entire study area.

E: *Ports, Quays, Harbours*
Ports_1_final.tab; Ports_2_final.tab; Ports_3_final.tab; Ports_4_final.tab; Ports_5_final.tab; Ports_6_final.tab; Pre Industrial Ports and Harbours.tab

These tables include, as the title suggests, ports, quays, harbours and other features that have a direct link to the use of the waterway, such as ferry crossings, lighthouses, boat houses etc. Polygonal and linear data has been drawn around these areas. So far this information has been split into six different tables, from 'Ports_1_final.tab' to 'Ports_6_final.tab', each one depicting a different time period based mainly on the map data used as the main sources. The tables include a number of data fields containing information about the type of site, the name of the site, brief notes about the site, sources used and other standard data fields included in our digital mapping. Many of the sources are abbreviated: the full list is included in the 'cartographic sources' section at the back of this report.

Where it has been possible, which is in most cases, the polygons have been drawn quite tightly around the known boundaries of the sites, but this may exclude associated features that are not necessarily depicted on the map sources. As a result these tables are accompanied by a separate mapinfo table incorporating a 100m 'buffer zone' around the sites. The original visual format for these tables are colour-coded according to the date they depict, but as digital tables this visual format can always be amended by the user depending on the application to which it is put. So far, there are seven different tables:

1. taken from a variety of maps that pre-date the 1st edition Ordnance Survey (OS) maps, depicting a fairly wide date-range from the 18th to the mid 19th century. Although their dates vary these sites have been put together in a single table due to the

lack of consistent and accurate coverage of pre-OS maps. The main sources for this table are the various parish tithe maps, the earliest being 1830 but mainly dating from 1838 to 1849. Estate maps have also been used, dating from the mid 18th through to the mid 19th century, but these tend to only cover small areas. Sites marked as disused on the 1st edition OS maps, but not shown on earlier maps, are also included in this table.

2. taken from the 1st edition OS maps. Coverage, detail and dates vary, but due to the lack of complete coverage by any one type of 1st edition map, this table encompasses them all. The most detailed are the 1:500 maps, which date to 1861-4, but only cover the settlements of Pembroke, Pembroke Dock and Haverfordwest. There are also the 1:2500 OS maps, although these can vary widely in date from 1864 through to 1890. These maps also have fairly good coverage throughout the area, although unfortunately there are gaps in coverage in sections of Burton, Coedcanlas, Lawrenny and Upton parishes, as well as Milford Haven town itself, so for these areas the less detailed 1:10560 maps were used, dating to 1866 and 1887.

3. taken from the 1:2500 2nd edition OS maps. These give good coverage to the area and are generally fairly accurate. These maps date to either 1907 or 1908.

4. taken from the 1:2500 3rd edition Ordnance Survey maps dating to 1937 and 1939. Unfortunately the only available copies of these in digital format barely cover the Milford Haven area and Haverfordwest areas. Other areas therefore lack a lot of detail, but any sites that existed on both the earlier 2nd edition OS maps and the 1964-75 OS maps are also included in this table.

5. taken from the 1:10,000/1:10,560 Ordnance Survey maps dating from 1964 to 1975. These maps are at a larger scale and consequently lack the detail of other maps.

6. modern port, quay and harbour areas, taken from the current Mapinfo Landline data.

'Pre Industrial'. Areas of ports, quays, harbours and other maritime activity taken from a variety of documentary and non-map sources illustrating known and likely areas of maritime activity prior to the 18th/19th century industrialisation of the waterway. As these sites are not taken from accurate map sources so their accuracy varies and are indicative only.

F: Industrial Areas

Industrial_1_final.tab;Industrial_2_final.tab;Industrial_3_final.tab;Industrial_4_final.tab; Industrial_5_final.tab;Industrial_6_final.tab.

Polygonal and linear data has been drawn around areas of industrial activity, ranging from isolated limekilns to large collieries, quarries and oil refineries. The sites chosen are those that are either located on, or near, the waters' edge, or are close enough to suggest the river played a role in their function and development.

These tables have been created in the same way and using the same sources as the Ports, Quays and Harbours table, and are also divided into six different time periods along the same lines and using the same visual format.

G: Military
Military_1.tab; Military_2.tab; Military_3.tab; Military_4.tab; Military_5.tab; Military_6.tab

These tables include areas and sites within the study area showing the military development and defence of the waterway in the same form as the industrial and maritime developments. These tables have by necessity used a variety of sources, sites of military importance have not necessarily been depicted on the map sources, therefore this has been supplemented by information taken mainly from an extensive survey of military sites undertaken by Roger Thomas, along with other more incomplete sources. These tables also divided into six different time periods along the same lines and using the same visual format.

H: Settlements
Settlements_1.tab; Settlements_2.tab; Settlements_3.tab; Settlements_5.tab; Settlements_6.tab;Settlements medieval.tab

These tables depict the extent of nucleated settlements, from hamlets to towns, within the study area, showing the expansion or change in the extent of these settlements over the past c200 years. These tables have been created in the same way and using the same sources as both the Maritime and Industrial tables, and are also divided into six different time periods along the same lines and using the same visual format. The settlements chosen are generally those that are situated on the waters' edge, where it can be reasonably assumed the waterway is playing an important part in their development. Although those slightly further inland may also have important links with the waterway, they have not been included here unless these links are demonstrated within the map sources.

Individual aspects of the settlements are not mapped, so that domestic areas are included with industrial areas, commercial areas etc. However, as buildings are generally fairly accurately mapped on both the OS maps and also on the tithe maps, the development and change in settlements can be fairly accurately mapped through the 19th and 20th centuries.

The 'settlements medieval.tab' is not taken from accurate map sources and is indicative only of known and suspected medieval settlements within the study area.

I: Archaeological Potential
Waterway Potential 1st attempt.tab; Land Potential 1st attempt.tab

The Waterway Potential table is explained in Appendix 4. This consists of polygonal data identifying differing areas of maritime archaeological potential within the waterway itself.

The Land Potential table is similarly explained in Appendix 5. This table consists of polygonal data identifying differing areas of maritime archaeological potential occurring on land within the study area.

J: Sites from Endex
NMGW mhaven.tab; PAS mhaven.tab; RCAHMW mhaven.tab

NMGW mhaven includes point data showing sites recorded by the National Museums and Galleries of Wales within the study area. Taken from the NMGW digital data. This table represents finds in point data form, although these cannot be accurately positioned.

PAS mhaven includes point data showing sites recorded by the Portable Antiquities Scheme, including finds reported by metal detectorists. Taken from the PAS digital data.

RCAHMW mhaven includes point data showing sites recorded by the RCAHMW within the Milford Haven Waterway HLCA area. Taken from the RCAHMW digital data.

K:General
HLC Milford.tab; Milford Project Boundary.tab; Sidescan ref grid.tab.

'HLC Milford' table includes the boundaries of the individual historic landscape character areas created during the Historic Landscape Characterisation of the Milford Haven area (see Murphy & Ludlow etc).
'Milford Project Boundary' table is the boundary of the study area.
'Sidescan ref grid' table approximately locates the sidescan survey charts undertaken in 1999 and provided by the Port Authority.

APPENDIX 2

Meetings & Consultations

Meetings

Scoping meeting – A scoping meeting was held at the PCNPA offices in Pembroke Dock on February 12th 2007 and there was an encouraging attendance of interested parties, resulting in a very useful discussion and offers of support for the project. These suggestions and offers of support were developed further during the next stage of the project. Relevant information was mapped onto GIS and included as part of the final report.

Consultation with specialists – an initial consultation with Nigel Nayling and Martin Bates from University of Wales, Lampeter was held on February 7th 2007, when the project was discussed at length. Consultation continued, especially with regard to interpretation of the bathymetric survey data for the Haven. Nigel Nayling has also introduced Vassilis Tsiairis to the project, a qualified diver and archaeologist currently working on the Newport Ship, and who also assists with the Nautical Archaeology Society (NAS) training weekends and is interested in working in the Haven.

APPENDIX 3

Resource Audit

Key Stakeholders and resources

Celtic Maritime Connections – Richard James is the Project Officer for Celtic Maritime Connections, and is also involved with the West Wales Maritime Heritage Society. Celtic Maritime Connections provides news and information about all aspects of maritime Pembrokeshire and works to highlight the history, heritage and culture found in abundance around the Pembrokeshire coast. The organisation (hosted by the MHPA) also seeks to develop coastal connections with other countries, including southeastern Ireland and Scandanavia.

Chapel Bay Fort – recently awarded a HLF grant to conserve and restore Chapel Bay Fort. Major George Gear has made available the numerous resources he holds regarding the military history of the Haven, and could help establish links with the Royal Navy Underwater Team of divers to assist the project.

Major Gear holds an extensive library of military history, both general and specific to the Haven and Chapel Bay Fort in particular, also a variety of charts and military plans. He is hoping to make these resources available for public consultation by prior appointment but the ability to provide this service is awaiting further funding. No website.

Countryside Council for Wales (CCW) – Skomer Nature Reserve Marine Officer Mark Burton has provided the project with copies of tiles from the Pembrokeshire Acoustic Survey conducted in 2001 and accompanying report. The quality of the multi-beam bathymetric data is exceptional and is available for further analysis. Some side-scan data may also be available for selected parts of the Haven in the immediate future.

Diving groups – Cardiff BSAC, mostly advanced divers, 6 currently enrolled for NAS training (Part One completed 17/03/07) who are keen to undertake diving projects within the Haven to help the project, and also to assist their progression through further NAS training levels. West Wales Divers (Contact - Ceri Jones) are also keen to run NAS training courses and dive trips.
On-going contact with diving groups, regarding training courses etc. within the Haven, is through the PCNP archaeologist Polly Groom.
Some diving groups have their own websites.

Environment Agency - The Environment Agency have indicated they will make the LIDAR data available for DAT use. There has not been sufficient time to examine the data as part of this project but it is hoped it will be useful resource in the immediate future.

Hydrographic Office - Digital hydrographic information is handled via 'Seazone'. A range of digital hydrographic data is available, as demonstrated on a sample information cd provided by Seazone that covers the Milford Haven area. This information was acquired free of charge for a months consultation only, but demonstrates the range of information that can be obtained. Information from Seazone can be accessed through their website www.seazone.com.

Haverfordwest Town Museum – Due to seasonal opening no initial contact was made and time constraints meant full and proper consultation was not possible with the museum. Information on the museum can be accessed through the council website www.haverfordwest-town-museum.org.uk/

Milford Haven Heritage and Maritime Museum - opens between April and October. Numerous archives and objects available for consultation.
See http://www.24hourmuseum.org.uk/museum_gfx_en/WA000049.html for further details.

Milford Haven Port Authority (MHPA) - A meeting was held with the Harbour Master, Mark Andrews, in January/February 2008. On behalf of the MHPA he pledged their support of and renewed their interest in the project and provided a range of paper-based hydrographic surveys of the Haven. These included geophysical surveys, borehole data and an engineering report undertaken along the main channel in the late 1960s and early 1970s ahead of a period of development. More recently there was a sidescan survey undertaken from Newton Noyes westwards in 1999 represented on black & white A2 charts. In 2001 there was a geophysical survey of the Pembroke Dock area to identify underwater obstructions. They have also offered to make contact with those who conducted the more recent surveys and to cover the costs of any reprints etc needed. Work is also underway by their GIS technician to produce a chartlet showing where works are planned or consented within the Haven. This will hopefully be available for us to consult in the near future. Information about the MHPA can be accessed through their website www.mhpa.co.uk.

Nautical Archaeology Society (NAS) – contact made with Vassilis Tsiairis, who is currently working on the Newport Ship and is keen to undertake an NAS related project in Wales. Vassilis has experience in underwater survey and excavation, and also recently assisted on the NAS training course in Chepstow. Enquiries have been made to NAS re: 'best practice' handbook for recording underwater archaeology, which could be made available to diving groups, etc. www.nasportsmouth.org.uk/

Pembroke Dock Museum – opens between April and October. Numerous archives and objects available for consultation. A visit was made to the museum in February 2008 and contact was made with Ron Watts, the Curator, Mike Hurley, volunteer and John Evans, member of the Trust as well as the Sunderland Trust. The museum is concerned chiefly with Pembroke Dock, covering its naval, airforce and army history with displays and artefacts. They occasionally receive artefacts from local people, discovered in attics and through metal detecting etc. Information about the museum can be accessed through the council website www.pembroke-dock.co.uk/Museum%20trust%20main%202.htm.

Pembrokeshire Coastal Forum – hosted by MHPA. Their co-ordinator Daryl Walsh has been extremely helpful in spreading news about the project far and wide, and a short article outlining the project and ways in which people can help has appeared in the Forum newsletter www.pembrokeshirecoastalforum.org.uk.

Pembrokeshire Coast National Park Authority (PCNPA) – liason with Park archaeologist Polly Groom and also John Evans of the Sunderland Trust Project. Side-scan data of the Sunderland flying boat wreck lying between the Pembroke Dock waterfront and Llanstadwell and Hazelbeach is potentially available.
Met with John Evans who kindly offered to make available the side-scan data of the Sunderland wreck, as well as providing useful background information and illustrative material on the Sunderland wreck. A website is available about the Sunderland project.
www.pcnpa.org.uk/
www.nasportsmouth.org.uk/projects/sites/sunderland01.php

Pembrokeshire Prospectors – metal detectorist club approached for their input into the project in terms of reporting finds to the PAS/HER. The group have been

encouraging feedback of information from detectorists relating to findspots, and also to encouraging responsible detecting and recording.
www.pembsprospectors.co.uk/

PLANED – community groups extremely keen to assist in undertaking rapid condition surveys of known sites within the HER within their particular community area. http://www.planed.org.uk/homemain/Ehomemain.htm

RCAHMW – an email outlining project has been sent to the newly appointed Maritime Heritage Officer, Deanna Groom. She will be in post as of 30/04/07 and a copy of this report will be sent to her for comment. NMR data records 246 wreck sites within the study area, although for most of these the presence or absence of material has yet to be ascertained.

A meeting was held between Louise Austin, PP, Polly Groom and Deanna Groom in January/February 2008. Deanna was keen to support the project and offered the use of her considerable expertise in maritime archaeology. A large amount of information on wrecks in the Milford Haven area is already available via the RCAHMW Coflein online database.

Receiver of Wreck – was contacted regarding Wreck Law and the *pro forma* for recording wreck information. Some information leaflets and forms were received regarding reporting finds, Wreck Law and diving advice. Request for information also sent regarding current known wreck sites for comparison with NMR data. An Excel table of recorded finds from the Milford Haven waterway has been sent across by Jane Cunningham, assistant Receiver of Wreck, which details the names of wrecks, their recorded location, finds retrieved from them, and droit number.
No further contact made.

Scolton Manor Museum – Mark Thomas is the Pembrokeshire County Council's Museums Officer. Visitor Centre opens between April and October. Numerous archives and objects available for consultation from April 2007 onwards.

West Wales Maritime Heritage Society – formed in 1984 to conduct and encourage research into the maritime history of the region and to encourage the preservation of craft, buildings and sites of historical or local interest. The Society boasts its own reference collection, temporarily housed in Haverfordwest Public Library, which comprises over 700 maritime books, ranging from technical to fiction, as well as a large number of nautical charts and photographs. Access to all this information has been kindly offered by the Society, and one of their members, David James, has recently published a comprehensive local maritime history of the Haven, *'Down the Slipway!'* (James 2006).

APPENDIX 4

Waterway Archaeological Potential

To be used alongside the Mapinfo table 'Waterway_Potential_1st_attempt.tab'.

In going through the study area looking at different areas of archaeological potential 75 individual areas have initially been created, however, many of these areas share similar characteristics and can probably be combined into the 13 different 'Area Types'.

In terms of archaeological potential three basic and broad groups are suggested, namely High, Medium and Low. 'Low' is where archaeological features, sites and deposits are unlikely to exist or survive, either because they've been dredged away or are unlikely to have been deposited in the 1st place. 'Medium' is where archaeological sites, features and deposits may survive but there may be little information about them, or where archaeological sediments are unlikely but wrecks sites may exist, for example. 'High' is where good archaeology is known, or strongly suspected.

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
1	Dredged Channel	MEDIUM	The main dredged channel, presumably dredged in the 1960s to allow passage for the oil tankers, and dredged repeatedly since. This is likely to have removed archaeological material, but left wrecks sites within the main channel below the levels of dredging.
2	Dredged Area	LOW	Area dredged between 1997 and 2002, according to the Seazone data. This is likely to have removed archaeological deposits and any shipwreck remains as deeper channels don't appear in this area. Wrecks are known immediately adjacent to this area however.
3	Dredged Area	LOW	Area dredged in 2003, according to the Seazone data. Presumably dredged as a turning point for the tankers. This is likely to have removed archaeological sediment, and as it is away from the main channel ship wrecks are unlikely to survive.
4	Harbour	HIGH-MEDIUM	A harbour that's seen a lot of important activity since the 18th century, being the site of military Docks, major fishing fleets etc, but this area was dredged in 1978 which is likely to have removed much of the sub surface deposits.
5	Dredged Area	LOW	An area in front of jetties, dredged in 1998 and 2003, according to the Seazone data. Likely to have removed any archaeological deposits and shipwrecks unlikely to survive.
6	Dredged Area	LOW	An area dredged in 1998 and 2003, according to the Seazone data. Likely to

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			have removed any archaeological deposits, it's unclear whether the channel was deep enough at this point to allow wrecks to survive, although it seems unlikely.
7	Dredged Area	LOW	Small area in front of Pembroke Dock dredged in 1986, according to the Seazone Data. This is likely to have removed any archaeological deposits and wrecks.
8	Dredged Area	LOW	Small area dredged in 1997, according to the Seazone Data. Likely to have removed any archaeological deposits and wrecks.
9	Main Channel	MEDIUM	The deep water channel within the lower reaches of the Haven, as taken from the bathymetric and Seazone contour data. As such is has probably always been a water channel although borehole data does indicate sands and gravels in places. Identified shipwrecks do lie within this channel however, with further possible wrecks visible on the bathymetric survey.
10	Rock Exposure	MEDIUM	An area that according to according to the Seazone depth data may be suitable for the survival of sub-surface deposits with archaeological potential, however, the bathymetric survey would suggest exposed rocks surfaces in this area and therefore few archaeological deposits other than wreck sites.
11	Rock Exposure	MEDIUM	An area that according to according to the Seazone depth data may be suitable for the survival of sub-surface deposits with archaeological potential, however, the bathymetric survey would suggest exposed rocks surfaces in this area and therefore few archaeological deposits other than wreck sites.
12	Slight Sediment/Deep Area	LOW	A deep water area that appears to have sediment survival shown on the bathymetric survey, punctuated by rock exposures. A borehole on the northern edge also recorded silty-sand overlying gravel. However, these deposits may occur at a depth that precludes archaeological deposits other than wreck sites.
13	Major Bay/Landing Point	HIGH	A now submerged foreshore area. Rock outcrops to the north and south indicate that this would formerly have been a more extensive sheltered bay then at present. Bathymetry indicates surviving sub-surface deposits, and possible wrecks

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			sites within the bay. The potential of these deposits have not been tested by boreholes. The bay itself is popular for swimming, shore angling and beach recreation.
14	Rock Exposure	MEDIUM	Rocky foreshore at the base of a cliff face. Will have seen a long exposure to the sea, and few coves or inlets probably make this an area of low archaeological potential.
15	Rock Exposure	MEDIUM	A small peninsula that would have formed the northern edge of an extended West Angle Bay. Now only Thorn Island survives above water. Unknown potential, although presumably would have been submerged fairly late in the sequence. Known wreck sites exist around Thorn Island.
16	Sediment	HIGH	Acoustic scan and earlier rockhead scan show sediment and higher levels in this area, although the southern edge isn't covered in the scans. Boreholes in 3 places show significant levels of sediment along the northern edge. Known wrecks sites also identified, other individual features also identified on the scans. The western half of this area is also a recorded anchorage point in the 16th century and probably during the medieval period as well. The inshore area provides shell fishing grounds.
17	Slight Sediment/Deep Areas	LOW	Area just outside the main channel and the area of dredging so there is some potential, but acoustic and levels suggest sediment may be minimal. and boreholes in this area indicate exposed bedrock. No known wrecks, but wreck potential.
18	Major Bay/Landing Point	HIGH	A sheltered bay, backed by rocky cliffs, described by Owen as having good landing although traffic into the bay would be limited by its depth and the presence of stones at the entrance. The foreshore consists of mud and sand and saltmarsh to the south. Angle harbour at the western edge has probably been in use since the medieval period, included in another area. Small-scale quarrying and limekilns along the edges indicates small-scale activity. Rhoscrowther to the east is an early med and medieval centre of activity, which is likely to have lead to some activity along the eastern side of the bay. Angle Bay is still used for general boating, dingy

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			racing, mooring, waterskiing and swimming.
19	Main Channel	MEDIUM	Main channel, although it doesn't appear to have been dredged/artificially widened. Potential limited to wrecks within the channel.
20	Main Channel	MEDIUM	The line of the main channel. No obvious dredging marks, but dredging is a possibility, also crossed in two or three places by underwater trenches/pipes. Archaeological potential limited to wreck sites, of which at least 2 are identified.
21	Possible Sediment	MEDIUM	This areas includes several fairly exposed bays and a coastline fronted by cliffs, so connections between the land and sea are possibly but unlikely to be heavily used. Acoustic survey indicates the rocky shoreline extends further into the waterway, so bedrock is probably exposed in many areas, but sediment may exist in between. The exposed beaches consist only of a thin veneer of sand over the rock, although the force of the sea tends to deposit most material in Castlebeach Bay. Mill Bay and Watwick Bay are both described by Owen as reasonably good rodes, but little used, Castlebeach Bay is not much use. Several known wreck sites, especially around St Ann's Head which is a bit of a wreck hotspot.
22	Rock Exposure	MEDIUM	Acoustic survey indicates this is a deep water area, just outside the main channel and area of dredging but possibly also always submerged. Boreholes also indicate exposed bedrock, so archaeological sediment potential is minimal. Wrecks sites are known and possible however.
23	Possible Sediment	MEDIUM	Area follows the underwater contour line. Acoustic survey indicates a fairly even spread of sediment with some rock exposures but borehole data suggests this sediment may be mainly sands and gravels, the potential of which isn't clear. This area does contain some large and well known wreck sites.
24	Major Bay/Landing Point	HIGH	Dale Roads, one of the main traditional anchorage points in the Haven, and the approach to both Dale Harbour and the adjacent beach, both important landing point since at least the medieval period and presumably earlier. Some known and suspected wreck sites lie within this area. Not covered by surveys or boreholes but

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			sediment survival would appear likely. The bay is still a popular launching point for boats.
25	Bay	MEDIUM	Small sandy bays, but without easy access, likely to have seen little use and therefore less archaeological potential. They aren't mentioned by Owen, and map evidence suggests they weren't really used for anything more recently. Levels suggest possible sediment survival, but not surveyed or boreholed. The bays are exposed to full force of the waves and the beaches are vulnerable to periodic loss of beach material. Watchhouse Bay of the western side is a waterskiing zone.
26	Major Bay/Landing Point	HIGH	Bay leading up to Sandy Haven Bay, a well used landing point since at least the medieval period. Small coves exist in the cliffs around the bay that could have also been used for landing, later activity appears to be limited to small-scale quarrying along the eastern side. Sediment survival possible within the bay, although no surveys or boreholes done. Relatively exposed to wave action, resulting in a dynamic beach.
27	Major Bay/Landing Point	HIGH	An area of coastline including small beaches and landing points that are mentioned by Owen as having good landing, and showing small-scale use on later maps, but the main area of later development was in the pill to the east. There is the potential for earlier archaeological survival in this area. Gelliswick Bay to the west is a small sandy bay now under intensive use as it provides the main access to the Waterway from Milford Haven town. The area has a yacht club, a public slipway and a beach popular with swimmers. The bay is also used for occasional short-term anchorage. Beneath the veneer of sand is clay, periodic erosion of the bay has resulted in a weakening of the clay. To the east is a rocky foreshore with shallow bays of sand and shingle. Localised pockets of sandy material accretes at obstructions forming sediment sinks.
28	Slight Sediment/Deep Areas	LOW	Area alongside the main channel, not recorded as being dredged but a relatively sharp edge showing up on the acoustic scan and the fact it lies in between known dredged areas may suggest it has in fact been dredged. The acoustic survey also indicates some

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			sediment may survive but the one borehole that lies in this area indicates exposed bedrock. Therefore likely to have low archaeological potential.
29	Main Channel	MEDIUM	A channel leading out of Milford Haven harbour, shown on the acoustic survey. It may have been dredged out, or might just have been caused by the passage of vessels, but it doesn't appear to be natural. This level of disturbance probably means archaeological potential is low.
30	Sediment	HIGH	Only a small area surveyed and boreholed but indicates sediment survival with archaeological potential. The stretch of coastline from Gelliswick to South Hook includes localised pockets of sandy material accreting at obstructions, forming sediment sinks. The Milford Shelf appears to present good anchorage but is fouled with old chains and moorings.
31 Castle Pill	Pill	HIGH	A pill with very high archaeological potential due to the build up of sediment and the known use of this area since the medieval period. Iron Age forts also suggest it used in prehistory, the centre of an important medieval manor, the site of a civil war harbour, and also the site of later post med ship building and breaking. Later activity may have resulted in earlier deposits and features being removed but there is still high potential for good survival. Today the pill provides well sheltered mooring for a number of locally owned small craft, but the swing bridge height limits use, and the fact it almost completely dries out at low water.
32	Major Bay/Landing Point	HIGH	A stretch of coastline that contains sand and gravel beaches and small valleys that may have seen archaeological activity, and has been used as beaching points etc in the post med period. Areas off Milford Haven and Llanstadwell are also described by Owen as 'good rodes'. Beach structures survive, such as quays and jetties, and maritime activity continues along this stretch of coastline. Some known and suspected wreck sites lie in this area. Borehole data suggests a good survival of alluvial sediment, and 'Milford Shelf' is described as fouled with old chains and moorings, and other possible archaeological features.
33	Pill	HIGH	The entrance to the pill is described by Owen as one of the most important rodes

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			in the Haven, therefore the pill is also likely to have been well used. During the post medieval period it was the home to ship building and other maritime activity. Masonry dock walls and piled steel quay walls form the edge to some of this area. The entrance to Barnlake Pill was formerly larger with offshore depths of 5-10m, large amounts of ship building in the 18th and 19th century. The intensive activity in the pill therefore indicates high archaeological potential.
34	Rivers, mud & marsh	HIGH	A large area of intertidal mudflats, forming a large shallow plateau extending up to 750m from the shore. These mud flats are probably the result of sediment being brought up the waterway and then deposited where the Cleddau and Pembroke rivers mix. Martins Haven, a small harbour possibly used since the early medieval period, also opens out into this area. The mudflats offer high palaeo-environmental and archaeo-botanical potential
35	Sediment	HIGH	Area bordering the main channel, but not dredged, and borehole data indicates very thick deposits of silty-clay. Potential here is therefore high in the sheltered area before the river swings out towards the sea. The eastern side, adjacent to the emergence of the Pembroke river, could be an area similar to those highlighted in the TEAM survey as being of high potential.
36	Main Channel	MEDIUM	Main channel of the Pembroke river as it emerges into the main Cleddau channel, shown on the acoustic survey. Sediment has obviously collected along its base but this is likely to have always been underwater therefore archaeological potential is low.
37 Crow Pool	Possible sediment	MEDIUM	Deeper water at the mouth of the Pembroke river, described by Owen as providing good anchorage although now the ground is foul and anchorage is discouraged. Potential unclear, sediment is likely to have survived but possibly all submarine.
38	Rivers, mud & marsh	HIGH	Pembroke river, a mix of deposits but all a variety of good potential. Intertidal mudflats and saltmarsh occurs throughout much of this area, with the possibility of peat deposits as were identified under the Pembroke power station. River crossings, ferry services,

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			ship building areas and quarry quays are all recorded towards the eastern end of this area.
39	Rivers, mud & marsh	HIGH	An area of intertidal mudflats presenting good archeo-botanical potential. Owen also describes this area as having no cliffs and good for landing, therefore the potential for earlier archaeology is possible, especially as much of the later post medieval activity was around the point so disturbance could be minimal. The mudflats are used for fishing oysters, cockles and scallops, although this is now declining.
40	Sediment	HIGH	Area outside the main channel where sediment survival could be good, although there is not survey or borehole data to confirm this.
41	Slight sediment/Deep Areas	LOW	Channels coming out from Pembroke Dock, the Titan Survey undertaken in this area did not identify this as archaeological significant, although sandy gravels were noted with bedrock exposures in areas.
42	Possible Sediment	MEDIUM	Acoustic survey shows a small 'island' of higher material in front of Pembroke Dock, borehole data indicates sandy-clayey-silt with shells, over stiffer clays, over the bedrock.
43	Sediment	HIGH	Area immediately in front of Pembroke Dock, identified by the Titan survey as consisting of muddy deposits, with some small magnetic signals picked up. The constant use of this area is likely to have both deposited objects but also disturbed deposits.
44	Sediment	HIGH	Acoustic and sidescan survey suggests deposits and possible underwater features in this area, although the nature of these is unclear. Lies off Pembroke Ferry, a ferry point in use since the medieval period, therefore there is the possibility of features connected to this. The foreshore is mudflat between Pembroke Ferry and Hobbs Pt, primarily fluvial sedimentation.
45	Major Bay/Landing Point	HIGH	Area fronting known beaching points and quays of Burton Ferry, in use since the medieval period. The underwater levels indicate survival sediment may be archaeological significant.
46	Possible Sediment	MEDIUM	Similar to northern side of the main channel, sloping river banks indicate this area may have filled up rapidly, but what little is shown on the acoustic survey suggests some sediment may survive of Palaeolithic/Mesolithic interest. No known

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			or suspected wreck sites.
47	Pill	HIGH	Cosheston Pill, bordered by intertidal mud flats. Potential is high, as it leads to a medieval village, and ferries used to come up there but it's probably now too narrow to be of much use therefore little disturbed, Palaeo-environmental importance too.
48	Main Channel	MEDIUM	The natural deep water channel, not dredged. Likely to be too deep for Palaeolithic and Mesolithic deposits, wrecks sites possible, none currently known.
49	Slopes	LOW	Relatively steep underwater slopes, although topped by intertidal mud flats in places. Small-scale riverside activity, boatyards, quarries etc, unlikely to have made much of an impact on these slopes, and their steepness is likely to limit the sediment potential.
50	Slopes	LOW	Steep underwater river banks, probably low potential.
51	Sediment	HIGH	Acoustic survey shows sediment exists in this area, including deposits of dumped waste-ballast etc-from ships turning into/out of the Carew river. Sediment of archaeological potential. There are a number of private moorings at Roose Lodge.
52	Rivers, mud & marsh	HIGH	Area around Carew Castle, includes the mill pond created by the mill dam. Any quayside activity etc associated with the medieval settlement is likely to be situated in this area.
53	Rivers, mud & marsh	HIGH	Carew River, flanked by tidal flats and apparently canalised in places. As a waterway it gives access to a medieval settlement and Upton Castle, so has been in use, but was also apparently canalised in part during the major quarrying at West Williamston.
54	Rivers, mud & marsh	HIGH	Deeper water in front of Lawrenny quay and at the junction of Carew and Cresswell rivers. Seen a lot of river traffic, especially 18th and 19th century industrial traffic and there is probably good potential for waste products and boats associated with this. Plenty of slipways also in this area, remains may extend out under water.
55	Rivers, mud & marsh	HIGH	The Cresswell River, flanked by tidal muds. Part canalised in places, used heavily during the coal and stone extraction of the 18th and 19th century.
56	Main Channel	MEDIUM	Natural deep water channel, with steeply

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			cut sides.
57	Slopes	LOW	Steep submarine slopes probably limits any potential in this zone.
58	Possible Sediment	MEDIUM	Acoustic survey indicate some potential sediment surviving on a shelf overlooking the main channel, not sure whether this would be an archaeologically good position though.
59	Pill	HIGH	Garron Pill, mostly intertidal mud flats now, but fronts quarries and a shipyard with known quays so there is both palaeo-environmental/archaeo-botanical potential and associated archaeological remains.
60	Possible Sediment	MEDIUM	Acoustic survey suggests there may be some sediment surviving here, overlooking the main channel, but position and slopes indicate the potential of archaeologically significant deposits is probably relatively low.
61	Sediment	HIGH	Llangwm Pool, an area of relatively flat bottom which the acoustic surveys indicates has sediment, probably of archaeological potential. Also lies just in front of a moderately sized quarry with quays and a known ferry point.
62	Main Channel	MEIDUM	The main deeper channel as depicted on the acoustic survey, levels are higher so sediment may survive of archaeological significance.
63	Slopes	LOW	The area where Llangwm Pill emerges into the main channel. The tidal muds of the bay are included in the land potential, this area may be the same as the main channel as it soon begins to slope down.
64	Sediment	HIGH	Narrow sloping coastal shelf edging the main channel, a continuation of the mud and gravel beach and therefore potential deposits.
65	Rivers, mud & marsh	HIGH	Tidal mud flats in front of Landshipping Quay, Landshipping Ferry and Cantons Yard.
66	Rivers, mud & marsh	HIGH	Local private ferry crossing, with possible medieval origins, in the upper reaches of the river where the channel is not too deep.
67	Rivers, mud & marsh	HIGH	Ford crossing of the river.
68	Rivers, mud & marsh	HIGH	Upper reaches of the Eastern Cleddau, the river narrows and looses its tidal range.
69	Rivers, mud & marsh	HIGH	Local ferry crossing in use for some time, crosses the upper shallower reaches of the river. A rough slipway leads to a

AREA NO.	AREA TYPE	POTENTIAL	DESCRIPTION
			muddy hard, on the north side, flanked by soft mud and saltings. There are some private moorings in mid channel between the two ferry points.
70	Rivers, mud & marsh	HIGH	
71	Pill	HIGH	Millin Pill, a small pill in the upper reaches of the river, may've been used to transport quarry material down.
72	Main Channel	MEDIUM	The confluence of Eastern and Western Cleddau.
73	Rivers, mud & marsh	HIGH	
74	Rivers, mud & marsh	HIGH	Tidal mudflats along the rivers edge, backed in places by marsh, cut in places by small stream tributaries. This area fronts a couple of areas characterised by industrial activity, quarrying and coal mostly, that required crossing these mud flats. Ballast from the ships that used the industrial quays was offloaded near the small ports of Hook and Little Milford.
75	Rivers, mud & marsh	HIGH	The upper reaches of the Western Cleddau

APPENDIX 5

Land Potential

To be used alongside the Mapinfo table 'Land_Potential_1st_attempt.tab'.

In going through the study area looking at different areas of maritime archaeological potential 74 individual areas have initially been created, however, many of these areas share similar characteristics and may possibly be combined into the 9 different 'Area Types', although these areas probably contain more unique characteristics than the 'waterway potential' areas.

In terms of maritime archaeological potential three basic and broad groups are suggested, namely High, Medium and Low. Unlike the waterway potential the land-based potential presented a more complex variety of issues making it difficult to confidently ascribe different degrees of potential. Essentially archaeological sites exist in all the areas, so it could be said the entire area is of High archaeological potential. This is made all the more confusing by the fact this particular study has been looking solely at maritime sites or sites directly associated with the waterway so a fully rounded grasp of the archaeology has not been obtained. Anyway, the areas have tentatively been broken up into High, Medium and Low. 'Low' is where maritime archaeological features, sites and deposits are unlikely to exist or survive, either because the area has been heavily developed or no sites, or only minor sites, have been recorded in that area with new sites unlikely. 'Medium' is where maritime archaeological sites, features and deposits may survive but there may be little information about them, or they may be relatively minor sites. 'High' is where good maritime archaeology is known, or strongly suspected.

The UDP policies are those shown on the UDP proposal maps as lying partly or wholly within each particular area, illustrating which policies are relevant to each area. The main settlements, such as Haverfordwest, Milford, Pembroke Dock etc, have a relatively large number of relevant UDP policies.

AREA	AREA TYPE	POTENTIAL	DESCRIPTION
1 St Ann's Head	Promontory	High	A promontory on the southern end of Dale Peninsula, forming the entrance to the waterway. Consists of well exposed high cliffs of hard Old Red Sandstone. The area has been occupied by the coastguard, with lighthouses and associated features existent for many years. Other uses include the medieval chapel, once an important landmark for ships entering the Haven, and military use during the wars. Specific features include lighthouses, coastguard station buildings, a small rock face quayside amongst others. The area is still in use by the coastguard but the head is a SSSI so development will probably be minor. The hard cliffs are also slow to erode.
2 Dale Promontory	Coastal Cliffs/Plateau	High	A peninsula formed mainly of hard Old Red Sandstone but also with areas of mudstones and siltstones. This forms an undulating plateau of around 70-100m OD that falls abruptly in hard rocky cliffs. The area is now mostly agricultural but includes areas of scattered WWII sites, although little now remains above ground other a few scattered buildings and ruins. It

			also includes an Iron Age enclosure, and a few small quarry sites. Clearly this plateau was mainly used for sites defending the waterway or using it for defence, the high cliffs limits contact between the land and water. Coastal erosion is limited and there appears to be little major development threats other than agricultural activity.
3 Dale Village	Historic Settlement	High	The head of the peninsula is cut by a wide alluvial valley within which sits the small village of Dale, fronted by a shingle beach and extensive intertidal flats. The village has medieval origins, becoming an important maritime trading and fishing village during the medieval period. Boats would have drawn up on the beach to the east and various structures would have been present, such as mooring posts, a pier is also mentioned in the 18th century. The bay also provided sheltered anchorage for ships travelling along the Welsh coast. Shipwrights, blacksmiths and inns would have been built in the village due to its maritime links. The village and beach is still well used as a launch site for diving trips, wind-surfers and jet-skis and is used as an anchorage for yachts. The beach and shoreline is relatively stable, although there is some erosion on the low banks behind the beach and the land behind susceptible to flooding.
4 Dale Airfield	Coastal Cliffs/Plateau	High	A plateau separated from the waterway by the wide valley of the Gann stream (area 5) and the outskirts of settlement at Dale (area 3). Includes a WWII airfield and other associated remains, with the potential for further remains. Although the airfield was only in use for a few years before reverting to agricultural use it is apparently surprisingly intact.
5 Garn Pill	Pills & River Valleys	High	A wide shallow valley formed by the Gann stream, opening out in Dale Bay to the south. The slopes are formed by Old Red Sandstone with areas of softer clay. The wide base of the valley contains intertidal mudflats, opening out onto Dale Flats. A sand-shingle ridge, called Pickleridge, has formed along the western side, which has formed lagoons behind. The pill has seen some development, but not intensive, and includes a range of archaeology. The shallow sandy bay is described as good landing in the 16th century so is likely to have a long usage, but possibly no definite structures. The tidal pill would've given boats access further inland, at least one wreck testifies to this. Quarrying is recorded along the pill (stone, sand, gravel and clay) from the 19th and early 20th century. Small settlements such as Mullockbridge and Crabhole house

			are recorded from the 16th century. Flood defence/land reclamation is visible at the northern end of the Pill. The development of the mudflats and lagoons may have limited use of the pill. There is some recreational use of the beach, but little development and the Gann Estuary is also a SSSI.
6 St Ishmaels to Monk Haven	Historic Settlement	High	Relatively steep sided valley cut through hard Sandstone cliffs leading down to the waterway. This gives way to the small shingle cove of Monk Haven. The small medieval settlement of St Ishmaels lies at the head of the valley, with the early medieval ecclesiastical site closer to the cove. The name of the cove suggests some link with this early ecclesiastical centre, and its likely boats would have drawn up on the beach to load and unload until the valley was cut off by 19th century gardens. Small-scale quarrying also recorded.
7 Loose Haven to Sleeping Bay Point	Coastal Cliffs/Plateau	Medium	The edge of a plateau at 70-100m OD, fronted by steep rocky cliffs of hard Old Red Sandstone. Small coves have formed in front of the cliffs, fronted by storm beaches. The steep cliffs mean there is little obvious direct maritime link but the area does contain some extensive WWII coastal batteries and AA guns. The hard cliffs mean there is little erosion, although the storm beaches suffer from some loss of material. The land on the plateau is under agricultural use.
8 Great Castle Head	Promontory	High	A rocky headland jutting out into the waterway, formed of hard Old Red Sandstone with steep exposed rocky cliffs. The headland was the site of an Iron Age enclosure. More recently it has been used as the site of a lighthouse and as a searchlight battery during WWII. The hard cliffs mean there is little erosion, the headland is now in agricultural use.
9 Rickeston to Sandy Haven	Pills & River Valleys	High	A long tidal pill opening out into a small estuary. The pill is flanked by mudflats in front of partially wooded steep slopes. Saltmarshes have formed at the mouth of the pill, which then opens out onto a sandy beach. The pill has seen some historical development, but not intensive. The bay was recognised as a good landing spot in the 16th century and probably earlier. Boats could have drawn up on the beach but a disused quay is located at the small medieval hamlet of Sandy Haven at the mouth of the pill. A ferry also used to operate across the pill. Tidal nature means the pill is accessible by boat, and inland wrecks attest to this. Small-scale industrial remains include coastal limekilns, and mills, possibly tidal. Some WWII sites, including a

			pillbox and radar station exist. There is still some recreational use for boats at Sandy Haven. The main beach is highly dynamic due to exposure to waves and there is some erosion on the eastern side of the bay. Saltmarshes should continue to form unless sea levels rise, and buildings at Sandy Haven are protected by sea walls.
10 Hebrandston	Inland Area	Medium	Undulating plateau of Old Red Sandstone overlooking Sandy Haven pill and bay. Contains the village of Herbrandston, with medieval origins. Old trackways link it to the Pill to the west, and a small valley connects with Sandy Haven bay, but no definite maritime links known. Apart from the village the area is under agricultural use, although it borders a major industrial area (area 11).
11 Esso Refinery	Modern Development	Low	An undulating plateau formed by Old Red Sandstone, dropping to steep rocky cliffs fronted by a small sandy and shingle foreshore, cut by the occasional small bay. Historic usage includes small-scale coastal settlement, including Iron Age defended enclosures, medieval and post medieval sites. The latter two clustered around small bays that may contain historic features connected with the use of the haven. However, heavy late 20th century industry is likely to have limited the potential for much of this archaeology. The western cliffs have been described as inerodable, whereas the southern ones are eroding, but only slightly. The site has been earmarked for future industrial development.
12 South Hook Fort	Promontory	High	Headland jutting out from a plateau of Old Red Sandstone, fronted by steep rocky cliffs and small sandy/shingle foreshore. Fortified in the mid 19th century and re-used during WWI and WWII. It appears to have survived the later 20th century industrialisation of this area, but does overlie earlier industrial (mining) remains of the post medieval period. No direct connection with the water known. Cliffs appear fairly stable and the site is presumable safe from further industrial development.
13 Waterston Oil Refinery and LNG Terminal	Modern Development	Low	An undulating plateau of Old Red Sandstone at 70-100m OD, dropping sharply onto rocky cliffs cut by a small shallow valley and bay. The cliffs are fronted by a rocky foreshore. Contains some settlement in Waterston, which has medieval origins, but formerly contained further small post medieval and medieval settlement, with some post medieval maritime activity recorded on the small bay. The site is now dominated by later 20th century heavy industry which is likely to have limited much of the potential, though there is still potential on the fringes.

14 Burton Ferry	Coastal Slopes	High	Relatively low cliffs with a sandy shelf in front, although does contain some relatively steep wooded slopes. Post medieval settlement is recorded along the coastal strip, and includes the site of Burton Ferry. The ferry itself probably has medieval origins, therefore settlement around it may also have medieval origins. Ferry also at Barnlake Point across the Pill, and now the Cleddau bridge crosses here, so it is the site of some major river crossings. Shoreline used for beaching, with structural remains at the Burton Ferry end, a large 19th century timber jetty was built here. The village still has maritime links, with an active pier and slipway etc.
15 Burton to Williamston Pill	Coastal Cliffs/Plateau	High	A riverside plateau cut by a series of small short steep-sided and wooded tributary valleys. The rivers edge is relatively low cliffs and some sandy shores in places. The small valleys and more gentle coastal slopes make maritime connections possible although nothing definite has been identified, other than some small quarries. Burton village lies at the head of a short valley at the western end, with medieval origins. Private moorings also exist at Roose Lodge at the northern edge of this area. The area is now mostly agricultural.
16 Benton Wood	Coastal Cliffs/Plateau	Medium	Edge of a plateau fronting the river, ending in steep wooded slopes, fronted by short sand/shingle foreshore. The shoreline to the north is steeper sided with less of a beach in front, but as the river sweeps around the eastern and southern sides are more accessible, evidenced by the remains of a small jetty. Historically a wooded area, settlement and other activity is rare. Benton Castle lies in this area, possible 13th century origins, but appears to have been sited for its isolation. There are no moorings here but the small bay does provide good overnight anchorage.
17 Llangwm	Pills and River Valleys	High	Centred around Llangwm inlet but also including an adjacent small inlet at the head of Port Lion. The land, on the edge of the coal measures, slopes down to the river, cut by stream valleys. The inlets are tidal, the streams surrounded by intertidal mudflats. Llangwm has medieval origins and a strong maritime link, noted for its local fishing until the 19th century. The mudflats may have limited maritime activity along the inlets, much of llangwm's boating has taken place from nearby Black Tar. Small-scale quarrying also recorded, typical of coastal sites where rock is exposed. Apparently there's a smugglers cave near Knap Lane. Agricultural use surrounds settlements.
18 Angle	Historic Settlement	High	Angle village occupies a valley opening out into Angle Bay, situated in a trough of carboniferous shale, sheltered by the

			harder outcropping Old Red Sandstone of Angle Point. The harbour, at the eastern end also opens onto gently sloping beaches and saltmarshes. At the western end it opens out into the more exposed West Angle Bay, surrounded by rocky foreshores with a sandy bay. Angle is a medieval planned town but it's likely there are some early medieval elements to the landscape around here, given the presence of chapels and cemeteries. To the east would have been a series of harbours, whilst to the west it was more exposed to the main channel, but still used, especially by industry in the later post med period. The small harbour provides some commercial and amenity value to the village, with informal recreation, general boating, dinghy racing and swimming. There are 120 moorings and occasional waterskiing. West Angle Bay is popular for swimming, shore angling, beach recreation and general sightseeing.
19 North Angle Peninsular	Coastal Cliffs/Plateau	High	Coastal fringe of Old Red Sandstone ending in high rocky cliffs and steeply sloping scrub covered slopes. Fronted by a narrow beach with several small shingle bays. This area overlooks a sheltered anchorage that appears to have been popular throughout the medieval and earlier post medieval period. Evidence of early medieval activity along this strip, and then 19th/20th century military activity. A lifeboat launch at the eastern end of the strip provides the only known jetty, although feature may exist at the WWII site. The area is now mostly agricultural.
20 East Blockhouse to Sheep Island	Coastal Cliffs/Plateau	High	High rocky cliffs of hard Old Red Sandstone with small shingle bays fronted by narrow beaches. Two tidal areas of Sheep Island and Rat Island also occur in this area. The cliffs back onto an undulating plateau of 70-100mOD. The cliffs separate this area from direct contact with the sea, but its location overlooking the entrance to the Haven means this area contained military sites concerned with defending the haven dating from the 16th through to the 20th century, as well as an Iron Age defended enclosure. The area is now agricultural with a radar station but otherwise no development.
21 Texaco Oil Refinery	Modern Development	Low	An undulating coastal plateau of mostly Old Red Sandstone that opens out steep slopes and small bays to deep water to the north, and onto more shallow sandy bays to the west. Fronted to the north and west by tidal mud flats. Historic use likely to be varied. Owen describes the bay to the west as good landing, and several, relatively small, medieval settlements are recorded throughout this area, although possible

			more agricultural than maritime related settlements. Small-scale industrial activity recorded around the coastline by the 19th century, likely to involve ships pulling up alongside, and a small quayside area is recorded on the north coast. Much of the potential is likely to have been diminished by the later 20th century heavy industry, although undeveloped pockets dot this area.
22 Pwllcrochan	Pills and River Valleys	High	A small sheltered valley cutting through the plateau and opening out into a small bay. The gradient of the valley slopes increase towards the mouth of the valley and the base of the valley becomes intertidal mud, saltmarsh and shingle. The small former settlement of Pwllcrochan lies within the valley, now just consisting of the church. The church has medieval origins and maps show a small hamlet by the later post medieval, which itself may've reduced from a larger medieval settlement. Easy access down to Martins Haven, which is likely to have been used as a harbour. Harbour structures are shown on late 19th century maps, but little obvious now remains. Highlighted as a site of possible palaeo-environmental and archaeological material. The site is now bordered by large industrial sites, which serves to make the area quite secluded, although a carpark and nature trail have been established by the church.
23 Pembroke Power Station	Modern Development	Low	The site of Pembroke Power Station, occupying a former natural eroded limestone bay at the mouth of the Pembroke river. The power station occupies the mouth of the bay fronted by intertidal saltmarsh and mud, and backed with former boggy land at the base of the bay. This was once an area of saltmarsh depicted on both historic and modern maps. Geographically this is an area of possible former lagoon and therefore containing archaeo-botanically important peat deposits, boreholing west of the power station revealed some peat deposits surviving, no doubt now affected by the power station.
24 Pembroke	Historic Settlement	High	The historic core of Pembroke Town, occupying a ridge surrounded by the Pembroke River to the north and the now diminished Monkton Pill to the south. Also extends to include the core of Monkton Priory and settlement to the west. The area is fully developed. The town of Pembroke has high-status medieval origins, along with the Priory and settlement at Monkton. There is also the possibility of Early Medieval and Iron Age activity at the castle site. This area now includes some nationally important archaeological sites and would have had

			strong maritime links since the at least the medieval period, with the area around the castle the focus of maritime activity. Known medieval maritime sites are rare, but could survive beneath later quayside expansion and development. Settlement development continues although maritime activity is now minimal.
25 Pembroke Modern Settlement	Modern Development	Low	Modern development occupying the limestone plateau around the upper reaches of the Pembroke river, expansion of the historic core of Pembroke and Monkton. Includes elements of straggling 19th century settlement around the historic cores, as well as some outlying agricultural land but the area was mainly developed during the 20th century. Some quarrying and other small-scale industrial activity recorded in the area, as well as some 20th century military sites. Modern development may have impacted on any earlier archaeological remains.
26 Historic Milford Haven	Historic Settlement	High	The historic core of Milford Haven town. Occupies the edge of a Sandstone plateau that slopes relatively steeply down to the waterway and is cut by Hubberston Pill to the west and Castle Pill to the east. Hakin on the west banks of Hubberston pill and settlement around Castle Pill are probably the earliest elements, though small and post medieval in nature. A civil war fort was also established at the mouth of Castle Pill. The town was developed in the late 18th century, and expanded in the later 19th century. Centred initially around extensive dockyard in Hubberston Pill, but also developing docks, shipyards, quays, wharves, etc along the coast and within Castle Pill. The area continues to develop placing pressure on the surviving archaeological elements.
27 Hakin and later Milford Haven	Modern Development	Low	A spread of mainly 20th century settlement expansion around the historic port towns, including some pockets of earlier settlement. In the area to the west of the historic core of Milford Haven this settlement expands to the rocky foreshore, fronted by bays of sand and shingle. This area borders sites such as Gelliswick Bay and Cunjeck Beach that were seen as suitable landing areas by Owen in the 16th century and presumably also earlier, although development around these site appear to be minimal. Pockets of earlier small settlements exist, and outlying maritime sites such as the observatory and telegraph station lay in this area. Modern development has obscured or removed earlier settlement traces, and potential archaeology around the coastal landing sites may similarly have been damaged.
28	Historic	High	An area of coastal plateau that probably

Liddeston	Settlement		has relatively minimal contact with the waterway, consisting of small villages with possible medieval origins, surrounded by agricultural land. Modern development around the coastal towns now borders and threatens to subsume these early village centres.
29 Land around Castle Pill	Pills and River Valleys	High	Steep sided and partially wooded valley slopes and valley head, cutting through the Old Red Sandstone plateau and into Castle Pill. The valley is backed by agricultural land to the north and east, and the settlement of Neyland to the west. The wide base of the pill is now full of intertidal mud flats at low tide. There is small settlement development at Black Bridge. This area covers the likely location for the important medieval manor of Pill. The castle has been identified at the head of the pill, but settlement around it hasn't, some is likely to have been around the castle, others along the banks of the pill, of which the western side has been redeveloped. The lack of intensive development in this area may have preserved archaeological remains but there is a threat of development encroachment form the west. The pill is still an important area for boating and recreation.
30 West of Monk Haven	Coastal Cliffs/Plateau	Low	Small area of hard sandstone cliff top with exposed cliffs in front, fronted by a small shingle foreshore. Very little recorded or potential archaeology other than small-scale quarrying which may've been accessed via the sea.
31 Gelliswick Bay	Pills and River Valleys	Medium	Narrow steep-sided and wooded valley opening out into a small bay, a remnant of one of the former tributary valleys formed during the last Ice Age. The bay is sandy, overlying clay, enclosed by harder rock cliffs. Identified as a good landing site by Owen in the late 16th century, and presumably also prior to this although no intensive archaeological activity is recorded here. Exposed peat deposits have been identified in the bay. Small-scale industry, ephemeral military sites and dispersed small-scale settlement have been recorded. With the 20th century expansion of Milford Haven this bay is now one of the most heavily used areas providing access to the waterway. The area has a yacht club, a public slipway and a beach popular with swimmers, the bay is also used as short-term anchorage. Intensive modern use is likely to have disturbed earlier archaeological remains. Peat deposits may indicate significant archaeo-botanical deposits survive, although periodic erosion occurs in the bay due to groundwater flow and high wave energy.
32	Promontory	High	A small semi-headland on the edge of a

Fort Hubberston			sandstone plateau overlooking Gelliswick bay. The site was developed as Fort Hubberston in the 19th century, two slipways on the western side serve the fort. The area is now enclosed on its landward sides by the 20th century expansion of Milford Haven town but the fort itself is designated a SAM.
33 Newton Noyes	Coastal Slopes	High	The edge of the sandstone plateau steeply sloping down to the waterway. The area is now occupied by derelict former military and industrial buildings around Newton Noyes pier, lying partly on reclaimed land. Owen records good landing at Newton Noyes in the late 16th century but this area was extensively redeveloped in the 19th and 20th century. The pier was initially built in 1872, connected to Milford Haven by railway and in industrial use. During WWII the area was again redeveloped by the Navy and also used by the US navy. 20th century sea defences protect the area from major erosion, the future use of this area has apparently not been determined but may be industrial.
34 Venn	Coastal Cliffs/Plateau	Low	A plateau of Old Red Sandstone 70-100mOD, fronted by a rocky foreshore. Under agricultural use, providing a barrier of agricultural land between the modern development of Neyland to the west and an oil refinery to the east. There is little obvious link to the waterway, and low Maritime archaeological potential.
35 Hazel Beach and Llanstadwell	Historic Settlement	High	A settlement along the edge of the coastal plateau and also extending slightly up a small valley. Low hard rock cliffs with a shingle foreshore are fronted by more extensive intertidal mud flats. At Castle Lake a shingle spit encloses a small area of saltmarsh. Llanstadwell developed around a medieval church, with possible early medieval origins, although it is not clear when settlement started to develop. By the early post medieval period the deep water in front of the mud flats was a popular anchorage, and boats could have drawn up on the beach and in the sheltered area at Castle Lake. By the 17th century, through to the 19th century, the area was apparently busy with small ships transferring cargo and beach structures are likely. Slipways and a stone quay now exist, the quay may formerly have been a pier. Small lighthouses are also recorded on the foreshore and beach in the 19th/ealy 20th century. Boats still moor at Castle Lake, and maritime activity continues in the village. The lack of foreshore develop may preserve archaeological sites.
36 Leonardston and Mascle	Historic Settlement	High	A small area on the Sandstone plateau containing small settlements and agricultural land.

Bridge			Leonardston has medieval origins, with distinctive field system around it, and Mascle Bridge settlement is shown on the tithe map. A lack of intensive development is likely to have preserved earlier archaeological remains, although the maritime link of these settlements is unclear.
37 Fort Scoveston	Inland Area	High	Scoveston Fort, a Scheduled Palmerston fort of the 1860s. Built inland to defend the Haven from landward attacks.
38 Historic Honeyborough	Historic Settlement	High	The historic core of Honeyborough, a medieval settlement, with strip field remnants to the west. The village is situated on the Sandstone plateau, around a kilometre away from Barnlake/Westfield Pill and the waterway. Extensive modern development around this historic core may've damaged some of the early archaeological remains, but it appears to have been quite an extensive medieval settlement. The focus of the settlement was probably more agricultural than maritime however.
39 Great Honeyborough and Westfield Pill	Coastal Slopes	Medium	A mixed coastal area on an undulating plateau of Old Red Sandstone, crossed by small valleys and also borders the steep slopes of the upper reaches of Barnlake/Westfield Pill. The area is mostly agricultural but also includes modern settlement around Honeyborough. The maritime archaeology of this area consists mostly of dispersed industrial activity, notably quarrying.
40 Neyland	Historic Settlement	High	Covers the area of historic (18th century) settlement, with its dockyards, piers, quays, landing points etc. Occupies a slight headland of hard Old Red Sandstone bordering the mouth of Barnlake/Westfield Pill and the main waterway, with areas of siltstones and conglomerates. Deep water lies off to the east, with tidal mudflats fronting the cliffs to the west. A small fishing settlement probably existed here prior to the 18th century, but a naval shipyard was established in the mouth of the pill in the mid 18th century, and Neyland subsequently became a major fishing port. The establishment of the railway terminus in the mid 19th century lead to a great increase in the settlement. This area covers the extent of the mid 19th century settlement with all of its maritime connections. The cliffs don't suffer from erosion, and sea walls also protect the area. Continual development poses the greatest threat to archaeology.
41 Black Hill	Early Industrial Area	High	A coastal strip with limestone outcropping and a sloping edge, fronted by tidal marsh and mud flats. Now used as agricultural land with dispersed settlement. Historically this is a quarrying area, mainly

			of the 18th/19th century. Quaysides were set up at the quarrying sites to allow direct access to the waterway. Little development in this area, the potential for surviving industrial archaeology is high.
42 Hook, Freystrop, Landshipping, Cresswell Quay	Early Industrial Area	High	A large area of undulating riverside plateau at 30-50mOD that lies across the Coal Measures, cut by wooded valley slopes. Dispersed settlement covers this area. The extraction of the coal characterises the archaeology across this area. Coal extraction probably began during the medieval period on a small-scale, but expanded dramatically in the 18th and 19th century. Freystrop, Hook and Landshipping were the main collieries, although surrounded by many smaller coal mines. Small ports expanded during this period, such as Little Milford and Landshipping, whilst major new ports were developed such as Landshipping Quay and Cresswell Quay, and wharves and quays were established around Hook and Llangwm. Settlement has continued to expand but mining remains still exist as do many of the portside features.
43 Carew	Historic Settlement	High	An area of villages and surrounding agricultural land, lying at the head of the Carew river, which is also joined by two further tributaries at this point. The villages have medieval, and possibly early medieval origins. The power centre was at Carew Castle, which may even have Iron Age antecedents, the ecclesiastical centre was at Carew Cheriton, and the industrial centre was at Milton. Sageston also has medieval origins, all with small settlements. Earthwork remains at Carew Cheriton suggest the medieval settlement may have been larger, this may apply for the other settlements and the subsequent agricultural use may indicate archaeology survives.
44 Carew Cheriton Airfield	Inland Area	High	A former airfield site occupying a plateau some distance from the main waterway. The airfield was RNAS Pembroke, later RAF Carew, a WWI and WWII airfield used by airships and aircraft involved in the Atlantic theatre of war. The site still includes runways and radar stations, headquarters etc. Many of the buildings have now gone, although the runways still exist and one of the control towers has recently been restored.
45 Jenkin's Point	Coastal Slopes	High	An area fronting the Cleddau and Carew rivers that has seen previous waterfront activity, now diminished or abandoned. Near Whalecombe Farm is a former chemical works, timber yard and limekiln, and an associated quayside. At Jenkins point is a former ferry crossing to Lawrenny

			Quay and Ferry Hill, and at Bank Farm is the former Canton's Yard shipbuilding site. These sites are now defunct, although slipways still exist and boats are drawn up on the shore.
46 Cosheston	Historic Settlement	High	An area drawn around the medieval village of Cosheston and its surrounding, surviving strip field system. No doubt once more extensive, but there is a rare survival of fossilised strip fields still visible. Modern development exists, would have had some riverside wharf or quay or beaching structures, though none are recorded.
47 Hakin Point to Llanion	Coastal Slopes	Medium	A coastal fringe area with moderately sloping edges down to the rivers and pills it fronts. Today this area is mostly agricultural, with some dispersed settlement. Settlement has traditionally been dispersed, there may be medieval settlement spread around Cosheston, otherwise Bangeston and Upton Castle also have medieval origins. There's evidence of relatively small-scale industrial activity and numerous relatively small military sites, now mostly gone. Ports and harbour evidence is slight although possible.
48 Pembroke Dock	Historic Settlement	High	The historic (early 19th century onwards) core of the settlement of Pembroke Dock. The settlement stands on an undulating plateau of Old Red Sandstone, with hard cliffs and steep slopes to the north and west dropping down to the waterway, including some artificial reclaimed land. To the south steep slopes border the Pembroke River whilst to the northwest gentle slopes drop to Cosheston Pill. Mudflats front much of the coastline around here. Prior to the early 19th century dockyard development there was some settlement at Pembroke Ferry, a ferry point since the medieval period, it is unclear what features existed at Paterchurch, but a fort was constructed in the later 18th century. The docks were established from 1812 onwards, with several improvements and enlargements until the mid 19th century, enlarging and burying previous quays and riversides. A planned settlement was laid out, concentrated around the docks then expanding eastwards. Also includes many military installations, some underground. Continual development threatens archaeology, but a lot of the traditional dockside buildings and military installations still survive. Commercial and private maritime activity still abundant in this area.
49 West of Pembroke	Coastal Slopes	High	A relatively low coastal fringe on the edge of a sandstone plateau with limestone outcrops that slopes to the Pembroke River. Cut by tributary streams feeding the Pembroke River, forming small embayments. Some sand and shingle

			fronts the slope, but it is mainly intertidal saltmarsh and mudflats flanking Pembroke River. The area is now mostly agricultural with some small settlement at Bentlass and settlement fringe around Monkton to the east. Easy access to the river but now fronted by tidal saltmarshes so current use is probably minimal. Historic use characterised mainly by limestone quarrying, for which boats would have beached in front of the quarries although Catshole Quarries also have concrete jetties. Bentlass was also a local ferry point and small-scale boat building area. Limestone coastline may also include cave sites, some of which may be buried beneath the mudflats, that contain very important archaeological evidence.
50 South of Angle Bay	Coastal Slopes	High	Covers level sandstone plateau overlooking Angle and coastal slopes leading down to Angle Bay. The area lies close to the prehistoric Ridgeway, therefore prehistoric archaeological potential is high although it is not necessarily linked to maritime usage. Has relatively easy access to the bay, although it's rocky at this point. Maritime activity appears to have been limited to small-scale quarrying, although coastguard station and rocket station also lie within this area. Angle WWII airfield occupies the level land.
51 Stack Rock	Promontory	High	Stack Rock, a small island fortified in the 1850s, although Saxton also shows a structure on the island on his 16th century map. Owen however, mentions nothing on the rock.
52 Haverfordwest	Historic Settlement	High	The settlement centre of Haverfordwest. Includes the large medieval town of Haverfordwest with its associated riverside activity, and surrounding medieval suburbs. Also incorporates modern expansion from this earlier core.
53 Uzmaston	Coastal Slopes	High	Coastal zone, now agricultural, fronting the upper reaches of the river. Some historical connection with the waterway, a boathouse and mooring posts are shown, and Uzmaston medieval settlement lies within this area. A lack of subsequent development may preserve deposits, but these are unlikely to be of great importance.
54 Haroldston Marshland	Floodplain	Medium	Low lying intertidal marshland, possible reclaimed, or formerly reclaimed in places. Palaeo-environmental potential, but maritime use appears to have been relatively slight.
55 Haroldston	Coastal Slopes	Medium	Agricultural land overlooking the upper reaches of the river. Includes a medieval building and church, and therefore has archaeological potential associated with those sites but in terms of maritime

			archaeological potential there is very little.
56 Hanton Bridge to Boulston Lodge	Early Industrial Area	High	Coastal area in the limestone belt, with small but steep and wooded slopes fronted by inter-tidal muds and marsh. As a limestone area quarrying is the main maritime feature mainly 18th/19th century, with small quays and jetties built into the river.
57 Boulston Manor	Coastal Slopes	Medium	Agricultural area and woodland on relatively gentle slopes to the river, fronted by intertidal mud. Contains a couple of small local slipways.
58 East Wood to Crafty Wood	Pills and River Valleys	High	Moderate coastal slopes down to the river bank, cut by small stream valley, and good beaching points. Limestone and coal also outcrops in this area so there are several small quays, beaching points, mooring areas etc. associated with ferries and quarries
59 Slebech Park	Historic Settlement	High	Discrete area around the Commandery, as a riverside site some sort of quayside is likely and therefore the potential for archaeological survival associated with this important site is great.
60 Slebech Park around upper reaches of Eastern Cleddau	Floodplain	Medium	Low lying flood plains, partly wooded. Reclaimed in areas, possibly offering palaeo-environmental and archaeo-botanical potential, perhaps significant near Blackpill but value not known.
61 Crafty Wood around Eastern Cleddau	Coastal Slopes	Medium	Steep wooded valley slopes, little direct archaeological potential
62 Minwear Farm	Inland Area	High	Agricultural area overlooking the upper reaches of the river. The step coastal slopes probably means this area actually has little connection to the waterway, although there is good potential for medieval settlement remains around Minwear.
63 Minwear Pill	Coastal Slopes	Medium	Coastal slopes cut by small stream valleys, with small-scale activity clustered at the entrance to these valleys, mostly limekilns with a mill on Minwear Pill.
64 Sam's Wood	Coastal Slopes	Medium	Coastal strip with relatively steep slopes but then fronted by muds and gravel beach. Some small settlement and industrial sites show these areas may have been used to draw boats onto, but probably always on a small scale.
65 Lawrenny	Historic Settlement	High	Lawrenny and Lawrenny Quay, a medieval settlement and likely medieval quayside area. Lawrenny quay has a long history as a ferry point, but was also a major quay in the 18th and 19th century industry. Coal and stone was shipped down from upriver to be loaded onto larger sea-going/coastal vessels here. High potential.
66 South-west of Garron Pill	Coastal Cliffs/Plateau	Medium	River cliffs, backed by steep wooded slopes with agricultural land behind. Little potential and little links to the waterway.

67 Llangwm Ferry to Garron Pill and West Williamston	Early Industrial Area	High	An area of limestone quarrying, includes channels cut through marshland to allow access to the rivers. Limestone quarry begun in the 16th century. Provided stone for the Havens fortifications.
68 North side of Cresswell River	Coastal Slopes	High	Relatively gentle slopes, easy access to the river, therefore there is the potential for unrecorded archaeology. Specific industrial sites are recorded, quarry and tannery, but little is known about these sites and further remains presumably await discovery.
69 East of New Park	Coastal Slopes	Medium	Coastal area, waterway is accessible but no recorded archaeological activity.
70	Floodplain	Medium	Floodplain, tidal marsh.
71 West Pennar	Coastal Cliffs/Plateau	Medium	Steep slopes probably separate this area from the waterway, but potential includes WWII military remains and the small ?medieval settlement of West Pennar. ORS cliffs, steeply sloping but not exposed sheer. Fronted by mud flats.
72 Fort Popton	Promontory	High	Popton Point Fort, Palmerston fort with a slipway connecting to the water. Built on an unrecorded Iron Age hillfort.
73 Sawdern Point	Promontory	Low	Sawdern Point, small outcrop, no known archaeological sites.
74 East Side of Angle Bay	Coastal Slopes	Medium	Low coastal land, possible area used by nearby early medieval and medieval settlements giving access to Angle Bay.

APPENDIX 6

Relevant Pembrokeshire JUDP Policies

POLICY 66 LANDSCAPE DIVERSITY AND TRADITIONAL LANDSCAPE FEATURES
The pattern and diversity of Pembrokeshire's landscape shall be protected and development and land use changes will only be allowed where the integrity and coherence of the local landscape character is retained and enhanced. Development and land use change that would result in the loss of local landscape features will only be allowed where such a loss, either individually or cumulatively would not damage the character of the area.

POLICY 67 CONSERVATION OF THE PEMBROKESHIRE COAST NATIONAL PARK
Development and land use changes will not be permitted where these would adversely affect the qualities and special character of the Pembrokeshire Coast
National Park by:
i) causing significant visual intrusion; and/or,
ii) being insensitively and unsympathetically sited within the landscape; and/or
iii) introducing or intensifying a use which is incompatible with its location; and/or
iv) failing to harmonise with, or enhance the landform and landscape character of the National Park; and/or
v) losing or failing to incorporate important traditional features.

POLICY 72 DEVELOPMENT REQUIRING A COASTAL LOCATION
Development of the undeveloped coast will not be permitted.An application to develop within existing areas of developed coast will only be permitted where:
i) the development requires a coastal location or, where appropriate, involves restructuring and regeneration urban areas; and
ii) the land is not subject to flooding, inundation or erosion from the sea; and
iii) the development does not prejudice the capacity of the coast to form a
natural sea defence; and
iv) the siting and appearance of the development does not harm important views, or vantage points, including views from coastal inshore waters; and
v) the development harmonises with the surrounding townscape or landscape.

POLICY 75 SHORE BASED FACILITIES
The development of shore-based facilities, including those linked to proposals below mean low water mark, will only be permitted within developed areas of the coast provided that:
i) it would not be detrimental to the landscape character of the coast; and
ii) it would not harm the nature conservation value of the site; and
iii) it is compatible with adjacent land uses or port activities; and
iv) it is compatible with the existing recreational and/or commercial activities in the locality; and
v) it does not conflict with the sustainable management of the coast.

POLICY 79 DEVELOPMENT IN A CONSERVATION AREA
Development will only be permitted in Conservation Areas where it preserves
or enhances the character or appearance of the Conservation Area. Particular regard will be paid to whether:
i) the scale, form, materials and detailing respect the characteristics of buildings in the area; and
ii) historically significant boundaries or other elements contributing to the established pattern of development in the area are retained; and
iii) important views within, into and out of the area are protected; and
iv) trees and other landscape features contributing to the character or appearance of the area are protected.
The development of land adjoining, or near to, a Conservation Area will only be permitted where it would have the effect of preserving or enhancing the character or appearance of that area or its setting, taking into account the foregoing criteria.

POLICY 81 LISTED BUILDINGS _
Development (including change of use, works of extension or alteration) affecting listed buildings or their settings will only be permitted where the special architectural or historic interest of the buildings, or their settings, would not be adversely affected.

POLICY 82 DEMOLITION OF LISTED BUILDINGS
Development involving the complete or substantial demolition of a Listed Building, including any features of special architectural or historic interest which
contribute to the reasons for its listing, will only be permitted where:
i) it is not practicable to continue to use the building for its existing use; and
ii) there is no other viable use for the building; and
iii) preservation in some form of charitable or community ownership is not possible or suitable; and
iv) redevelopment would produce substantial planning benefits for the community which would decisively outweigh the loss resulting from demolition.

POLICY 83 PROTECTION OF BUILDINGS OF LOCAL IMPORTANCE
Development affecting buildings which make an important contribution to the character and interest of the local area will be permitted where the distinctive
appearance, architectural integrity or their settings would not be significantly adversely affected.

POLICY 84 ARCHAEOLOGICAL REMAINS
Development which adversely affects important archaeological remains and/or their settings will not normally be permitted.

POLICY 85 HISTORIC LANDSCAPES
Development that would adversely affect the integrity, coherence or character of Landscapes of Historic Interest will not be permitted.

POLICY 86 HISTORIC PARKS AND GARDENS
Development that would adversely affect the character of Historic Parks and Gardens, or their setting, will not be permitted.

MILFORD HAVEN WATERWAY PORTS & HARBOURS PROJECT.

RHIF YR ADRODDIAD / REPORT NUMBER 2008/38

Ebril 2008
April 2008

Paratowyd yr adroddiad hwn gan / This report has been prepared by

Philip Poucher

Swydd / Position: Archaeologist

Llofnod / Signature ..... Dyddiad / Date

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by

ar ran Ymddiriedolaeth Archaeolegol Dyfed Cyf.
on behalf of Dyfed Archaeological Trust Ltd.

Swydd / Position:

Llofnod / Signature ..... Dyddiad / Date

Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw sylwadau sydd gennych ar gynnwys neu strwythur yr adroddiad hwn

As part of our desire to provide a quality service we would welcome any comments you may have on the content or presentation of this report