Gloucestershire

COUNTY COUNCIL

Contents

List of figures

Summary

This document represents the Phase 1 report into the Rapid Coastal Zone Assessment survey for the Severn Estuary, undertaken by staff of Gloucestershire and Somerset County Councils on behalf of the local authorities of Gloucestershire, South Gloucestershire, Bristol City, North Somerset, Somerset and Exmoor National Park, and funded by English Heritage through the Historic Environment Enabling Programme.

The project has been carried out in accordance with the Project Design (Mullin 2005) and version 2 of the English Heritage brief for RCZAs (Trow & Murphy 1999). The aims of the project were to enhance the archaeological record of the coastal zone and contribute to the shoreline planning of the estuary by collecting and integrating information from a variety of sources including the Marine and Terrestrial Archaeology Databases in the NMR; the National Hydrographic Office, Taunton; the Maritime and Coastguard Agency's Receiver of Wreck; County SMR/HERs, County Record Offices; aerial photographic collections; post-graduate university theses and academic research papers.

The results of this phase of the project provide:

- *A record of all known archaeology within the intertidal zone and its immediate hinterland*
- *An assessment of current erosion patterns and threats this poses to the archaeological resource*
- *An enhanced understanding of the archaeological resource*
- *An overview of coastal change from the Palaeolithic to the present day*
- *Identification of sites which need further investigation as part of Phase 2 of the RCZA*

This report is one of three printed products of the phase 1 RCZA. Other reports summarise the results of the NMP mapping of aerial photographic information (Dickson & Crowther 2007) and of an assessment of Environment Agency Lidar data for trial areas within the estuary (Truscoe 2007).

1 Introduction

1.1 This document forms the phase 1 report into the Severn Estuary Rapid Coastal Zone Assessment (RCZA). The project was funded through the English Heritage Historic Environment Enabling Programme and undertaken by staff of Gloucestershire and Somerset County Councils. The project was carried out in accordance with the Project Design (Mullin 2005) and version 2 of the English Heritage brief for RCZAs (Trow & Murphy 1999).

1.2 This version of the report is a second draft, revised on the basis of English Heritage comments. It is proposed that it will be further revised after a pilot phase 2 fieldwork stage and the report into NMP mapping of aerial photographic information have been completed.

1.3 The archaeological resource in the Severn Estuary is under threat from various natural processes such as coastal erosion, exacerbated by the high tidal range and strong currents within the Estuary. Other threats include ongoing development pressure along the shoreline, marine aggregates extraction within the estuary itself and proposals for new coastal defensive and realignment measures. A "*desperate need to achieve a comparable level of general reconnaissance on the English side*" as exists on the Welsh side of the Estuary has been identified and this needs to be coupled with a synthesis of archaeological and palaeo-environmental data (Turner *et al.* 2001: 7-8). The Severn Estuary was also identified as a priority area for further coastal research in *England's Coastal Heritage* (Fulford *et al.* 1997) and up-to-date knowledge of the archaeological resource will be essential to inform the second stage of the Shoreline Management Plans (SMP2). SMP2 for the north coast of Somerset will start in late 2008, and that for the rest of the Severn will follow soon after. The SMP2 process is due to be completed by March 2010. Pressures on the existing coastline are many and varied, and there is an increasingly urgent need to understand more clearly the extent and nature of the archaeological and palaeoenvironmental resource in order to identify the likely impact of these natural and man made threats.

1.4 The physical environment of the Severn Estuary means that organic and environmental evidence is well preserved, offering data not available on dry-land sites. Much palaeoenvironmental work has been carried out in the estuary, particularly in the last 15 years (Bell 2001) and studies of sea level change and coastal movement have also been undertaken. Work remains to be done, however, both on a regional scale and on individual sites (Rippon 1997a: 270-271).

1.5 Although work has been undertaken in the inland wetland areas of the Severn Estuary, systematic archaeological projects were not carried out in the intertidal zone until the early 1980s. Many of these were carried out in Gwent and elsewhere on the Welsh side of the estuary (Rippon 1997a: 18). Important work was carried out at Brean Down, Somerset, by Martin Bell between 1983 and 1987 (Bell 1990) and Richard McDonnell undertook survey work in Bridgewater Bay between 1993-4 (McDonnell 1995a). The Severn Estuary Levels Research Committee (SELRC) has published much of the research in the estuary since 1985 and this has concentrated on the area between Gloucester and the River Parrett and the right bank of the estuary between Gloucester and Cardiff.

1.6 The proposed construction of the Severn Tidal Barrage prompted detailed survey between Beachley Point, Maisemore Weir and Hinkley Point (SELRC 1988, McDonnell & Straker 1989) and the building of the Second Severn Crossing included extensive archaeological evaluation and excavation, largely undertaken by Wessex Archaeology and the Glamorgan Gwent Archaeological Trust.

1.7 The limited studies carried out to date within the inter-tidal area have shown that the existing level of archaeological information held on national and local authority databases significantly under-estimates the nature and extent of the resource in the coastal zone (SELRC 1988, McDonnell 1995a, Hilditch 1998).

2 Survey area

2.1 The survey area is taken as being primarily the inter-tidal zone of the Severn Estuary from Gore Point, Porlock Bay, Somerset, to the present tidal limit at Maisemore Weir, Gloucestershire (Figure 1). The west bank of the Severn, where it lies within England (between Maisemore and Beachley Point), was also included in the survey. As this is one of the longest stretches of coast considered by an RCZA, with the greatest tidal range, the total survey area covered for aerial mapping purposes amounts to 498 square kilometres.

2.2 The survey includes both an assessment of surviving remains within the inter-tidal zone and the immediate hinterland of this area, taken as land between Lowest Astronomical Tide (Chart Datum) and 1km on the landward side of MHW (Figure 2). Sites located within urban areas, such as Gloucester, Bristol, Avonmouth and Weston-super-Mare were excluded from the study.

3 Methods

3.1 Introduction

The methodology was divided into three main tasks: the assessment of the archaeological resource, the analysis of coastal change and the mapping and recording of aerial photographic information to English Heritage national Mapping Programme (NMP) standards. These tasks were entirely desk-based, but allowed an evaluation of the threats which coastal change poses to the archaeology of the intertidal zone and its hinterland, as well as augmenting existing information about the archaeology of the Severn Estuary.

3.2 Information sources and analysis

3.2.1 Tabular and spatial data collected from Gloucestershire, South Gloucestershire, Bristol, North Somerset, and Somerset HER/SMRs was loaded as a set of ArcGIS layers within the project GIS. These data were then queried to produce chronological maps and overviews for the major periods (see Sections 7 and 8). As this data is difficult to fully exploit in the form supplied, a synthesis of the available published and unpublished data for the RCZA survey area was also produced, based on a trawl of information in the archaeological literature, the Victoria County History and theses held in the libraries at Reading and Bristol universities (see 6 below). A full list of the sources consulted is given at 17 below.

3.2.2 Data was analysed through a GIS environment, with mapping and data sources loaded into the project GIS, which was then utilised to identify significant concentrations of archaeological sites and areas of coastal erosion. Areas of archaeological significance were thus identified, and an assessment made of the threat to these from coastal change. Areas of few recorded archaeological sites were also identified as needing further work in order to verify whether this reflects a real lack of sites, or merely a lack of fieldwork in these areas.

3.3 Coastal change

Coastal change was assessed by the analysis of aerial photographs and cartographic sources, coupled with the synthesis of previous palaeoecological work and studies of sea-level change. The archaeological resource was assessed by reference to existing data sets such as the Maritime Archaeology Database held by English Heritage and information from a diverse range of sources including local record offices, the National Hydrographic Office, university theses and Shoreline Management Plans produced by the Environment Agency. A detailed summary of the evidence for coastal change is given at 10 below.

3.4 Aerial photographs and Lidar data

In order to better understand the archaeological resource in the intertidal zone and its immediate hinterland aerial photographs of the RCZA survey area were analysed and transcribed to NMP standards by staff working at the National Monument Record, Swindon. Two sample areas of Lidar data were also analysed in order to assess the usefulness of this data in the coastal environment. The results of this analysis are presented as two separate, stand-alone reports to be submitted to English Heritage with this phase 1 report (Crowther and Dickson 2007, Truscoe 2007). Although work on the NMP has not been completed at the time of production of the 2nd draft of this report, 697 new records have so far been added to the NMR AMIE database and 279 records have been revised. It is estimated that, on

completion, the Severn RCZA NMP will have resulted in the identification of over 900 new sites and the revision of almost 400 known ones, providing a massive improvement in baseline data for informed management of the archaeological resource and stage 2 Shoreline Management Plans.

3.5 Appraisal of the success of project methodologies

3.5.1 A total of five HER/SMR databases were queried for the Severn RCZA survey. None of these utilised a common data standard, or used the same GIS. The quality of the baseline data within this survey is therefore somewhat varied.

3.5.2 It is impossible to use HER/SMR data alone to undertake a survey such as the one presented here, and a good literature search was found to be a more effective tool, especially as this picked up data not recorded in HER/SMRs, such as unpublished theses and palaeoecological studies. Furthermore, general and synthetic material is very poorly represented in HER/SMR data, which is more focussed on sites and monuments. For example, relevant information from the 17 volumes of 'Archaeology in the Severn Estuary' has not been systematically added to the Gloucestershire SMR.

3.5.3 The data produced by DEFRA's FutureCoast survey was invaluable in assessing recent coastal change and presents detailed information about projected coastal change within the Severn Estuary over the next 100 years. The document also deals with the morphology and historic change of the coast in far more detail than might be possible from a short assessment of historic maps and charts.

3.5.4 The NMP mapping of the coastline, although hugely productive in the identification and location of archaeological sites, was more time consuming than originally envisaged largely due to the tidal range and consequent lack of reference points for mapping. The estimated overall rate of progress of 20 days per quarter sheet used in the project design (Mullin 2005) proved to be insufficient for the reasons detailed below:

- Due to the extensive areas of estuarine mud and silts shown on many aerial photographs of the intertidal zone in the Severn Estuary the lack of hard reference points made the process of rectification and georeferencing oblique and vertical photographs in AERIAL5 more complicated and time consuming than encountered elsewhere on land or during other RCZA projects in areas with a less extensive tidal range.

- Previous work on the Quantocks and in the Forest of Dean had suggested that the Severn coast would be, with a few obvious exceptions, relatively quiet in terms of the number of archaeological features to be recorded. However, the land areas mapped have proved to contain extremely complex and dense concentrations of earthworks; particularly ridge and furrow and river defences on the left bank in Gloucestershire and numerous phases of drainage channels around the Somerset Levels and the mouth of the River Parrett.

- Estimates of the number of 1km squares in the PD were based on counting km squares that were within 1km (in both directions) of the coast as mapped on road maps, which were the only maps available at that time. The purchase of MasterMap (which includes accurate low and high water mapping) and other scales of OS mapping was included as a cost in the PD (Mullin 2005, Appendix A).

- Mapping narrow strips of 1km squares has only previously been attempted as part of the Suffolk RCZA NMP project. It has become apparent that under this situation each km square cannot be mapped and recorded at the same rate as 1/25th of a quarter sheet. The estimate suggested by Helen Winton at English Heritage Aerial Survey as

appropriate for dense archaeology when mapping and recording km squares is currently 30 days per 25 km squares.

- Although training time was allowed for, the time taken for newly recruited staff to come up to the same rate of progress as experienced staff was underestimated.

- Various standard tasks undertaken by NMP staff (routine supervision/monitoring, meetings, public searches, presentations, data transfer to and from HERs, fieldtrips etc.) are not included in the standard 20 days per quarter sheet estimate for the duration of NMP work.

It is recommended that the above are taken into account for future similar projects. An interim NMP report has been produced for those areas completed during phase 1 (305 of 498 km squares) and remaining mapping has almost been completed at the revised rate of 30 person days per 25 km squares.

3.6 Recommendations for methodologies to be adopted in future projects

3.6.1 SMR/HER data should be supplemented by a literature review for the survey area. This should include both palaeoecological and archaeological literature, as well as a survey of unpublished PhD theses.

3.6.2 FutureCoast data should be used to assess past and projected coastal change. Where possible, this should be used in conjunction with CHAMP data.

3.6.3 Although historic maps and charts are useful, many were shown to have poor data value for the RCZA in the Severn. Similarly, tithe maps were shown to have no data value in the Phase I RCZA. Although it is potentially useful for Phase II work to have prior knowledge of the location and potential use of historic maps and charts, Phase I work should be limited to identifying the location and potential usefulness of this data source, rather than its detailed analysis.

3.6.4 Detailed discussions should be held with staff of English Heritage's Aerial Survey and Investigation team before the designing of NMP projects. Issues such as a lack of control points and the time taken for new staff to become familiar with coastal monument types should be allowed for. Estimates of monument density based on surrounding areas of different landscape type (i.e. non-coastal) may be inaccurate. An accurate shapefile of the area to be covered should be an essential pre-requisite.

4 The sedimentary background

4.1 John Allen (2001a) has discussed the Holocene development of the Severn in some depth and a summary of coastal change is presented in Section 10, below. A brief introduction to the sedimentary context of the archaeological deposits in the estuary is given here, however, as these are frequently referred to in the literature.

4.2 The Holocene sediments are known as the Wentloodge Formation (Allen & Rae 1987), which can be sub-divided into the following:

- The Lower Wentloodge Formation consisting of thick silts with no or few thin peats, dating to roughly the Mesolithic/Neolithic period

- The Middle Wentloodge Formation consisting of thick peats alternating with silts, dating to the Bronze/Iron Age

- The Upper Wentloodge Formation, which consists of thick silts with no peat, dating to the Romano-British period. This formation is widely exposed intertidally due to coastal erosion.

4.3 The older Holocene deposits in the Elmore, Longney, Rodley, Arlingham, Awre and Slimbridge Levels are thick, mainly woodland peat with intertidal silts above and below it (Figure 3). The top of the peat is generally at 5m OD and has been dated to 800-200 cal. BC. Further Holocene deposits are known at Lydney Level, Berkeley Level, the Vale of Gordano, the North Somerset Levels and the main Somerset Levels. The silts within the Holocene deposits represent salt marsh and tidally influenced wetlands, as well as intertidal mudflats.

4.4 The Wentloodge Formation is incomplete over large areas of the estuary, the upper strata of the deposit being truncated in places due to the reclamation of land from the river and the construction of associated flood defences. In sheltered areas of active saltmarsh, silt has been deposited over the last millennium and this reflects episodes of coastal retreat and advance during this period (Allen & Rae 1987). The Rumney Formation underlies the highest saltmarshes and is divided into an Upper and a Lower deposit, dating to the medieval and early Modern periods. Hewlett (1997) has pointed out that, according to Allen, the Upper Wentlooge formation started to form at the end of the Roman period but that the Rumney formation did not start to accumulate until the 15th century, suggesting a hiatus in sedimentation between *c.*1400 and 550BP. The Awre Formation (Allen 2001b) lies below saltmarshes at an intermediate level and appears to have been formed in the 19th century, whereas the Northwick Formation appears to have begun to be formed during the middle decades of the 20th century and is located in the lowest saltmarsh.

5 Historic maps and charts

5.1 Assessment of historic map data

5.1.1 Historic maps and navigation charts for the RCZA survey area were consulted by visits to Gloucester, Bristol and Taunton Record Offices. The maps and charts were quantified and recorded in a database and their usefulness for future, field-based work assessed, based on the following scale:

- Maps and charts of high data value which can be digitised and accurately georeferenced within the project GIS.

Maps and charts of intermediate data value which may require verification as part of Phase II.

- Maps and charts of no data value which are either highly inaccurate or unable to be georeferenced.

Digital photographs were taken of any documents of high potential and sources consulted are listed in Appendix A.

5.1.2 Although tithe maps exist for all of the 66 coastal parishes within the RCZA survey area, an assessment of a random sample of ten from each county showed that these were of poor information quality for the RCZA. The potential of these maps lies in the apportionment descriptions of individual fields, but analysis of this would be extremely time consuming and beyond the scope of the RCZA at this stage.

5.1.3 The majority of historic maps were found to be of generally low potential for future work, although many have already been assessed and entered into HERs. Ordnance Survey mapping had higher potential, and MHW and MLW from the 1880, 1900 and modern maps was digitised to assess historic coastal change (see Section 12).

5.2 Collection of historic chart data from the Hydrographic Office

5.2.1 Historic navigation charts held by the UK Hydrographic Office in Taunton were also assessed for the RCZA. As charts are generally prepared for the purpose of navigation, the surveys are more concerned with accurately mapping depth and the nature of the channel, rather than coastal archaeology and their potential is generally low. There are exceptions, however, in particular the 1849 Beechly survey of the Bristol Channel, which has good detail of fish weirs and other features, and the 1853 Alldridge survey which again shows fishing features and a submerged forest off Stolford. The accuracy of these charts has been tested in the field by McDonnell (1995a) who suggested that there is a degree of metrical accuracy to the representation of these features, but that many have been damaged or destroyed by coastal change, particularly in the area around the River Parrett. There is, however, potential for their survival elsewhere. Despite their high potential, the charts are very large-format and it was not possible to digitally scan them and assess their suitability for digitising or georeferencing into a GIS. It is recommended that this is further explored as part of Phase II of the RCZA.

5.2.2 The UKHO has three catalogues of charts, spanning the period up to 1930; 1930 to 1970 and 1970 to present. A total of 154 charts covering the RCZA survey area are listed in these catalogues, most of which date to the period between 1850 and 1930. Particularly significant are the 1832 survey of the Severn by Commander Denham and the subsequent

resurvey of 1849 by Captain Beechly. The 1853 survey by Commander Alldridge is also potentially useful.

5.2.3 Also present at the UKHO is a bundle of documents and micrographs relating to the private research of the former curator, Adrian Webb. These are generally copies of material held by Gloucester and Bristol Record Offices, dating from the 18th century onwards. Of particular interest in this collection is a map (TNA MFI/54) which dates from 1768 and shows the River Parrett.

5.2.4 The Hydrographic Office also holds Sailing Directions, which describe the charts, from 1839 to present. The current Sailing Directions (UK Hydrographic Office 2005) describe stakes still in use for fishing in Weston Bay and their potential hazard for shipping.

6 Previous research into the archaeology of the English Severn Estuary

6.1 The right bank: Introduction

The RCZA survey area begins at Beachley Point and runs along the right bank of the Severn to Maisemore (Figures 4, 5 and 6). The inland extent of the coastal zone in this area is partly defined by the A48 road, although the RCZA survey area is slightly larger, running to 1km from MHW. This part of the survey area has been discussed by Putley (1999) and Green (1997), and a number of surveys have been carried out into the nature of the coastal archaeology, in particular by Brown *et al.* (2006), Allen (2000, 2001b, 2003a), Fulford & Allen (1992) and Fulford *et al.* (1992).

6.2 Beachley to Lydney

SMP Process Unit 9, Figure 4

6.2.1 The southern extent of the survey area is dominated by the "Old" Severn Bridge, which replaced the Old Passage Ferry when it opened in 1966. The buildings and piers associated with the ferry were surveyed by Allen (2003a), who pointed out the lack of archaeological work on Severnside waterfront features associated with ferries and other trades. River pilots are recorded as living in Beachley in the 19th century (Elrington, & Herbert 1972, 71) and pilots remained in the village into the 20th century. Boatmen formed the largest group of non-agricultural workers in the parish in the 19th century (ibid).

6.2.2 The southernmost section of Offa's Dyke extends to Sedbury Cliffs, the area north of this forming part of Tidenham Chase. The part of Offa's Dyke within the survey area is protected as a Scheduled Monument (SM 34859, Figure 22). Sea walls are mentioned at Tidenham in the 13th century (Elrington, & Herbert 1972, 51) but by 1969 they were no longer maintained. Fisheries are mentioned in the Anglo-Saxon period (ibid), with 65 basket weirs in the Manor and sturgeon, herrings and porpoise listed amongst the fish taken. At Domesday a total of 56 ½ fisheries are mentioned, 53 of which were in the Severn (the rest being in the Wye). A fishery at Lyde Rock to the north of Beachley Passage is noted in 1573. In the early 19th century the main fishery was in Beachley Bay where both putcher weirs and boats using stop-nets were used; a total of 14 hedges of stakes containing over 1700 putchers are recorded in this area in 1837 (Elrington, & Herbert 1972, 51). In 1866 the fishery on the Severn at Tidenham consisted of 754 putchers to the south of Slimeroad Pill and 375 at Lyde Rock, as well as a total of 13 boats using nets. A putcher weir at Slimeroad Pill was still in use in 1969 (ibid).

6.2.3 Townley (1999) recorded a number of new sites including fish traps, weirs and baskets during a survey of the intertidal zone between Stroat and Woolaston and also produced a plan of the fishponds at Woolaston Grange. A boat was also recorded in the side of Grange Pill and this was later excavated by Dr A.J. Parker and students from the University of Bristol, but could not be accurately dated.

6.2.4 Brown *et al.* (2006) carried out survey work at Woolaston, in an area of peat deposits and submerged forest around the mouth of Grange Pill. The lower peat here is located between –1.5 and –2.7m OD and the jaw bone of a roe deer was found within it at –2.51m OD. This overlies a head deposit with a buried land surface at its top. The bottom of the peat is dated to 6819 ± 33 BP (5775-5635 cal. BC) and organic bands near to its top are dated to 5420±40 BP (4335-4245 cal. BC).

6.2.5 The upper peat at Woolaston lies at between –0.9 and +2.1m OD and has trunks of substantial oak trees within it. A 50m wide palaeochannel is located 120m to the west of Grange Pill and this also contains the trunks of trees. There is also evidence for woven

structures in this channel. The base of the upper peat here was dated to 5256 ± 35 BP (4230-3970 cal. BC), the top of the deposit being dated to 4910±40 BP (3770-3640 cal. BC).

6.2.6 Dendrochronological work carried out on submerged oak timbers at Woolaston suggests that these date from 4096 to 3699 cal. BC and are largely contemporary with the period of peat formation (Brown 2005, 178; Timpany 2005).

6.2.7 Also at Woolaston, Brown (2005) identified a number of periods during which quantities of charcoal were present in the palaeoenvironmental record and suggests that this is a product of the burning of the reedswamp in the Mesolithic period to encourage grazing animals which were subsequently hunted. Unfortunately very little archaeological material has been recovered from the area to support this suggestion (Brown 2005, 215).

6.2.8 The environmental (pollen) sequence at Grange Pill begins prior to 5775-5635 cal. BC, when the environment was dominated by oak, lime and elm, with lime being the dominant component. Peat formation occurred 5775-5635 cal. BC and resulted in alder carr woodland dominating the remainder of the lower peat deposit. Alder was also present in wood samples within the peat alongside willow and hazel. The period from the top of the lower peat is characterised by transition from alder carr woodland to reedswamp and then saltmarsh, between 4230-3970 cal. BC. The reedswamp appears to have been repeatedly and deliberately burned during this period, a phenomena also known elsewhere in the estuary (particularly on the Gwent Levels) during the Mesolithic period. Alder carr woodland and peat formation returned *c.*4230-3970 cal. BC and oak wood from this deposit has been dated to between 4096–3669 cal. BC.

6.2.9 Brown (2005) suggested that Grange Pill is an artificial cut, which replaced the palaeochannels to its west in the 12th-13th century, and is contemporary with the construction of two quays surveyed by Fulford *et al.* (1992). The Lower Quay is of stone and timber construction and covers an area of 12x5m and a single dendrochronological date was obtained for this structure, giving a felling date of after 1172. The Upper Quay is larger (12x15m) and better preserved, but of similar construction and was dendrochronologically dated to after 1100, with a possible repair or improvement after 1206. Both quays appear to have been linked at some point, but it appears likely that the Upper Quay replaced the Lower Quay due to rising sea levels. The construction of the quays date to the period at which the Manor of Woolaston was given to Tintern Abbey (1131) and it is likely that the quays were constructed on behalf of the Abbey. The structure is not on the Estate map of 1787 and there are no surviving documentary sources referring to it, suggesting it might have gone out of use due to the development of Cone Pill in the early 18th century (Allen 2000).

6.2.10 The most extensive work to have been carried out in this area is the series of excavations at Chesters villa (inland of Guscar Rocks, Scheduled Monument GC102, Figure 22) by Fulford and Allen (1992), building on work by Scott Garrett in the 1930s (Garrett 1938), which revealed evidence for a residential range and bath block. Aerial photographs suggest that the villa also had both eastern and northern ranges and a courtyard. Iron working debris was found in the intertidal zone near the villa in the 1980s and tap slag and charcoal was found in the same field as the villa during fieldwalking. Remains of a timber framed building were found during excavations and this contained evidence for two iron smelting furnaces. Other features, including a boundary ditch were also excavated, but none of these were directly related to iron production. The date of the iron production is no firmer than 250-400AD, although Fulford and Allen (1992) suggest that the activity utilized ores mined outside the immediate villa area and took place over the spring and summer on a part time basis.

6.2.11 Fisheries are recorded at Woolaston and Aludredston in 1086 (Elrington, & Herbert 1972, 112-3) and the Duke of Beaufort had 400 putchers on Horse Pill in 1866. Salmon fishing was historically very important in the parish, but shrimp fishing was also carried out since at least 1707. Naval frigates are said to have been built at Cone Pill up to 1646 and two

sloops sailed regularly to Bristol in the 18th century (ibid). Flour and paper were sent from the Pill in the late 19th century and sailors and boat builders are mentioned in living in the parish in 1608 with sail makers carrying out their trade here through the 18th and 19th centuries (ibid).

6.2.12 Most of the southern part of Lydney parish has been reclaimed from the Severn (Herbert 1996, 47) and a tradition recorded in 1770s says that the river used to flow next to the church, which is now 1.6km from the present bank. Land was being accreted by the river through the 14th century but a major episode occurred in the early 17th century when *c.*300 acres was deposited on what is now called the New Ground (ibid). This was subsequently washed away, but began to reform in the 18th century when it reached *c.*280 acres in extent (ibid).

6.2.13 A fishery belonging to either Purton or Poulton manor is recorded at Lydney in 1086 (Herbert 1996, 73-4) and there were fisheries in Purton in 1269. Putchers are recorded in 1419 and five putchers are recorded at Wellhouse Rock in 1651. Stop nets were in use in the 19th century and a weir of 650 putchers is recorded at Aylburton Warth at this date. Nass manor maintained 300 putchers at Fairtide Rock below Nass cliff, reached by a ladder down the cliff face which was still in use in the 1990s.

6.2.14 Boats were trading out of Lydney in 1270 (Herbert 1996, 73-4) and Wose Pill at Aylburton was used by Llanthony Priory to ship wood. Lydney, Purton and Wose Pills were all in use for trade in the 16th century with ships being built in the parish in 1608. Navy frigates were also built here in the 17th century. Lydney was one of the two main ports for the Forest of Dean in the post-medieval period and, when the ancient harbour was adversely affected by changes in the course of the River Severn, the principal user (the Lydney and Lydbrook Tramway) cut a new channel to the river. This channel took the form of a canal almost a mile in length with a tidal basin being added at its entrance in 1821 and a limekiln probably being constructed at around this date. The eastern end of the harbour, including a swing bridge, is a Scheduled Monument (County Number 474).

6.2.15 Allen (2001b) carried out an extensive survey of Lydney Level and discussed at length the geomorphology and soils of this area. Coastal erosion here has driven the right bank of Cone Pill inland over many metres, revealing a section of Plusterwine Lane which is associated with 17th and 18th century pottery and tobacco pipes. Two jetties have also been revealed due to exceptionally rapid coastal erosion along this section of the coast (Allen 2000). Traces of ridge and furrow cover roughly half of Lydney Level, some of which has been affected by subsequent tidal siltation. This probably dates to the 11-12th century, but is poorly dated, as only 17th to 18th century pottery has been found during fieldwalking. At least four former shorelines are present on the Level and it is suggested that the enlargement of this area started in the second millennium AD, as the earliest shoreline is overlain by ridge and furrow. At least six episodes of seabank construction were identified by Allen (2001b), and many of these survive as upstanding earthworks.

6.3 Lydney to Maisemore

SMP Process Units 10-13, Figures 5 and 6

6.3.1 From the early Middle Ages Purton Pill was a minor port (Herbert 1996, 73-4). NB There are two Purtons, on opposite banks in Gloucestershire (Figure 5). Three owners of boats at Purton were presented at the forest eyre of 1270 for trading regularly to Bristol in wood and venison stolen from the Forest of Dean. In 1282 seven boats were based at Purton Pill which was used for shipping coal from the Forest of Dean mines until the opening of Lydney harbour. In the late 18th and early 19th centuries it was also an outlet for navy timber which was collected in a yard on the north side of the pill in Awre parish. Two vessels were

based permanently at Purton in the late 18th century: a brig which carried navy timber to Plymouth and a sloop used in the Bristol trade (ibid).

6.3.2 At Awre, to the north of Purton Pill, Allen and Fulford (1990a) identified two phases of land reclamation. Reclamation I is of 100ha and is dated by elevation differences to the Roman period. Reclamation II is 14ha and overlies silted ridge and furrow and is probably early-modern. The existing seabank here apparently dates to 1851. At Whitescourt, Awre, the beach is littered with iron slag, furnace lining, Old Red Sandstone tile and Romano-British pottery (Allen and Fulford 1987). Pottery of the 17th to 18th century is also present and a small amount of Iron Age pottery was also recovered here.

6.3.3 The eastern tip of Awre parish is formed mainly of land reclaimed from the river, possibly before the 12th century (Herbert 1996, 14-16). Land called Hayward was reclaimed *c.*1140 and land described as being formerly part of the Severn is mentioned in 1300. By the start of the 17th century more land was being deposited and is known as the New Warth. The *Main Sea Wall*, which survived until the early 20th century, is mentioned in 1846 and much renewal appears to have been undertaken in the 1840s. Land was also lost in the parish, notably to the south west of Awre Point. In 1234 the people of Awre sued those of Slimbridge, where new ground was accreting, for the return of their land, which was being washed away. Erosion removed several dwellings from around Woodend Lane in the 18th century resulting in the construction of new defences to the north east of Brimspill, but erosion continued at Woodend Lane into the 1980s.

6.3.4 Vessels often floundered on the Noose sandbank off Awre Point and on the point itself (ibid, 37-38) and Awre churchyard contains several burials of the drowned. Fisheries are recorded in the manor by 1300 and in the 1320s and 30s these fisheries produced a large income. A feature, probably a fishing weir, known as *Pucherewe* is mentioned in 1493. In the 18th century the main fishery in the parish was between Hayward and Brimspill and by about 1913 a tenant of Poulton Court had *c.*600 putchers in the river adjoining the farm, which the farmer still operated in the 1980s (ibid). A fishery belonging to Etloe Duchy manor is mentioned in 1283 and stop nets are recorded in the 19th century in use between Purton and Gatcombe (ibid).

6.3.5 Sailors are mentioned in Awre parish in 1608 and goods were landed at a number of places including Brimspill and Hamstalls (ibid). At Woodend there was a limekiln at the end of Woodend Lane and limestone was loaded there in the 1820s. Most of the trade occurred around Gatcombe, which was a part of the Port of Bristol in the 15th century, and much of the trade entering the Severn went no higher. In the 18th century iron from the Blakeney furnace was shipped to Bristol and the Midlands but by the late 18th century Gatcombe became a centre of the timber trade and a large yard, called Gatcombe timber yard, was constructed to the west of the hamlet in the early/mid 19th century. Shipbuilding was established in the parish by 1608 and a shipwright is mentioned in Blakeney in 1662 (ibid).

6.3.6 A medieval settlement known from documentary sources as Boxcliff is located near Box Rock (GSMR 19979), to the north of Awre. Slightly to the north of this settlement is Bullo Pill, originally used for boat building and subsequently developed by the Forest of Dean Tramroad Company as a port for exporting Forest of Dean coal and stone. Walker (2003) traced a track from the Forest of Dean to Portlands Nab, which was interpreted as the location of a ferry which ceased operation *c.*1600, probably as a result of rising water levels.

6.3.7 Fisheries are recorded from the 12th century at Newnham (Elrington & Herbert 1972, 43-44). Gloucester Abbey had fishing rights on the river and a fishery called Head's Row is mentioned in 1382 and continued in use until at least 1617 when it consisted of 6 putchers. Another row of 18 putchers, called Court Row, is mentioned in 1602 and other rows included 22 in Putchmeadow row (1561) and Gilbert Row. Two fisheries are mentioned in 1803 and long net fishing continued into the 20th century (ibid). Other fisheries recorded at Newnham include one upstream from Newnham's Ladder held by Bristol Abbey; one belonging to

Newnham manor which is mentioned in 1563 and another belonging to the Hill House estate which is mentioned in 1605 (ibid). Two fish houses are also mentioned in the parish: one downstream of Hawkins Pill and another at Collow Pill, which was still in use in 1968 and is a Grade II listed building.

6.3.8 Ships were built at Newnham in the 18th century, and these included some of the largest ships to have been built on the river. A new quay was built at Newnham in 1755 and buildings once used as warehouses with projecting pulley beams and remains of former quays can be seen in Severn Street. The remains of the quay can still be seen along the eastern side of the modern flood defence bank at the northern end of Newnham's waterfront and consists of two courses of stone blocks plus an upper course of lintels (Putley 1999b).

6.3.9 Shipwrights are mentioned in Broadoak in 1608 and ships were built in the hamlet during the late 18th and early 19th centuries (Elrington & Herbert 1972, 80). A considerable area to the west of Rodley has been reclaimed from the river (ibid) and an old sea wall is still visible. Reclamation continued in the 19th century and a new sea wall was constructed at the end of the century. The fishery of Garne and Rodley is recorded from 1157 and fishermen and fishmongers lived in the parish in the 18th and 19th centuries. In 1591, Rodley manor claimed keelage from boats unloading between Newnham Pill and Garden Cliff and sailors lived in the parish in the early 17th century.

6.3.10 Allen and Fulford (1990a) have identified a series of five land reclamations within a bend of the river at Rodley. Reclamation I totals 81ha and is ascribed to the Romano-British period based on height difference, but there is no archaeological evidence to support this. Reclamation II is in two parts, measuring 47ha and 90ha which are probably medieval in date and a third reclamation, measuring 170ha, is visible at Chaxhill. A fourth reclamation of 47ha is probably of post-medieval date and Reclamation V, visible at Rodley and Cleeve, is of suggested post-medieval date.

6.3.11 Salmon fishing was formerly important at Minsterworth and fishing for elvers continues today, although the archaeology associated with this activity and the archaeology of the river to the north of Minsterworth is poorly understood. Allen and Fulford (1990a) have, however, identified the flood defences from Over old bridge to Minsterworth, which enclose 260ha, as dating to not later than 1830, as documents from 1318 and 1784 refer to this area as water meadow.

6.4 The left bank: Introduction

Much work has been carried out on this side of the river and estuary by Allen (1986, 1991, 1992, 1997a, 2001a, 2003b) and surveys have been carried out of Porlock Bay (Canti *et al.* 1996), Bridgwater Bay (McDonnell 1995a), Gravel Banks, Avonmouth (Riley 1999) and Clevedon (Hilditch 1998). Extensive developer-funded work was carried out in advance of the construction of the Second Severn Crossing and the Seabank power station (see Locock 2000a, Gardiner *et al.* 2002). Rowbotham (1978) has described the changes in the form of the river channel in the Gloucester area and the sedimentary sequence below Gloucester is detailed by Allen & Rae (1987). Research by two PhD students has also examined the sedimentary and archaeological sequences of this area (Hewlett 1997, Druce 2001).

6.5 Maisemore to Purton

SMP Process Units 10-13, Figures 4, 5 and 6

6.5.1 The RCZA survey area begins at Maisemore Weir, but the archaeology of the stretch of river from here to Gloucester is poorly understood. The maritime/coastal archaeology of Gloucester is complex and poorly synthesised but it is known that the city acted as a major port in the Roman, medieval and post-medieval periods. No sites are recorded on the Gloucestershire SMR between Gloucester and Stonebench, although flood defences of unknown date flank the river here.

6.5.2 The area of land enclosed by the bend in the river at Elmore has been extensively discussed, due to the presence of a series of land reclamations in the inner estuary, which have been suggested to originate in the Roman period (Holbrook 2006, Allen and Fulford 1990a, Allen and Fulford 1990b, Allen 1990b). The Great Wall of Elmore runs for 800m across the alluvium at Bridgemacote and has a stone revetment along its south west side, suggesting that it is a sea defence, rather than a flood defence for already reclaimed land (Allen and Fulford 1990b). Hewlett (1997) studied the sedimentary history of this area and suggests that after the Great Wall was constructed sediment was excluded from the main bulk of the Elmore wetland and confined to the seaward side of it, as the clay was substantially thicker (1.26m) on this side. Hewlett also agrees that the Great Wall was constructed to prevent tidal, rather than fluvial, flooding.

6.5.3 Two reclamations, separated by the Great Wall, were identified by Allen and Fulford (1990a) at Elmore. Romano-British pottery was recovered from within this area and Saxon and medieval pottery has also been recovered from within both intakes. There is a 1.17-1.72m height difference associated with Reclamation I, which enclosed 280ha. Reclamation II takes in *c.*74ha and is 0.16-0.28m above Reclamation I but 1.25-1.48m below the present marsh. Ridge and furrow is present across this area and a house called the Doodings, which is encircled by the seabank, is recorded from *c.*1575. Allen and Fulford (1990b) have argued that the defences at Elmore and Longney are the first examples to be identified in Britain of Roman sea defences, although there is no direct archaeological dating for any of the defences and Hewlett (1997) has suggested that the models of saltmarsh accretion suggested by Allen cannot be relied upon. According to Hewlett, the models have not been confirmed by fieldwork and, significantly, the "Roman" reclamation at Elmore and Longney is contradicted by a radiocarbon date of 1570 ± 60BP (349 to 614 cal. AD) for a peat deposit which is overlain by 1.88m of sediment, suggesting that this area was not reclaimed until well after this date. Hewlett also points out the lack of precision over the dating suggested by Allen & Fulford and the absence of any radiocarbon dating evidence. Hewlett points out that six of the 11 "Roman" sites identified by Allen and Fulford's survey did not have any evidence of Roman occupation and substantial amounts of pottery were found only at two (at Elmore and Longney). In any case, these were found in recent deposits of sand-silt and could have been derived from elsewhere: the farmer at Elmore, for example is reported as having stated that the ground there has been recently "made up". Hewlett (1997, 306) goes as far as to state that "There would appear to be very little substantive proof to support the hypothesis that most of the wetlands were reclaimed during the Roman period" and that the majority of the reclamation is probably of late medieval date at the earliest.

6.5.4 Three episodes of reclamation were identified at Longney by Allen and Fulford (1990a): Reclamation I has an area of *c.*195ha, lies 1.3m below the level of the current active marsh and partially underlies the modern seabank. Reclamation II is smaller (*c.*37ha) and lies 1.1m below the contemporary marsh and appears to have taken in a former course of the Bollow Rhyne. Reclamation III is 0.9m below the current marsh and occupies *c.*5ha. Roman material has been recovered from the area of Reclamation I and has been recovered from two sites: Hillfield Farm and an area 150m to its south west. Finds of medieval material dating to the 12th to 14th century are confined to discrete areas within Reclamations I and II

but metalworking residues have been found across the whole area. Allen and Fulford argue that Reclamation I must be of later Roman date and Reclamation II of a similar date (although see Hewlett's arguments to the contrary, above) and both of these phases are mentioned in medieval and later sources. Reclamation III appears to be medieval and date to no later than 1327.

6.5.5 Hewlett (1997) also carried out palaeoenvironmental work at Longney and identified an identical sequence to that at Elmore, but the lower peat had been deposited on weathered or reworked Lower Lias rather than sand and gravel. Pollen survived only below the upper 1.5m of the core, but a total of five pollen zones were identified. The lower unit was dominated by tree and shrub pollen, in particular *Corylus* (hazel*), Quercus* (oak) and *Tillia*, (lime) interpreted as local woodland which was becoming increasingly wet. Tree pollen becomes dominant in the next identified zone, dominated by a rise in *Alnus* (alder) in the subsequent zone, interpreted as representing the onset of an alder fen environment, which deposited *c.*3m of peat. The fourth pollen zone sees a reduction in tree pollen and a marked increase in herbaceous types, such as sedge, which dominate the fifth zone. Further pollen analysis from Watts Farm identified only two pollen zones, corresponding to the interface between the peat and clay. The lower zone was dominated by *Alnus*, the upper by herbaceous pollen. It is suggested that an alder fen environment was rapidly replaced due to a rise in water table.

6.5.6 The course of the Severn at Longney may have originally been along the east side of the parish and the place name is Saxon for *long island* (Elrington & Herbert 1972, 206). A pool-reeve was appointed to look after the water courses in the manor and a river wall was constructed between 1287 and 1300. The defences are recorded in 1540, when they were said to be in poor repair, and again in 1553. By 1625 the owner of land at Epney was obliged to maintain the sea wall, presumably due to its poor state of repair. Fisheries in the parish were granted to Pershore abbey in the 12th century and a fishing weir is mentioned at Epney in 1216 with a fishery belonging to Longney manor recorded in the 11th century. A small house called the weir house is recorded in 1553 (ibid).

6.5.7 The, now disused, Stroudwater Navigation Canal locked into the Severn at Framilode but is now infilled. The canal was constructed between 1775 and 1779 and ran between the Severn at Framilode and Wallbridge, Stroud.

6.5.8 The sequence of coastal reclamation at Arlingham was discussed by Allen (1990b), who identified five main post-glacial morphostratigraphic surfaces:

- Surface 1 is the lowest lying and is contained by the seabanks shown on a map of 1725. These are mainly destroyed but survive as a slight ramp. Medieval ridge and furrow is located on this surface, which is interpreted as being no younger than medieval and is classified as the Oldbury Surface. Scatters of iron slag and Romano-British pottery on the alluvium to the south of Passage Pill were noted.

- Surface 2 lies between the 18th century seabanks and a clifflet which represents the 1802/1835 coast.

- Surface 3 is a clifflet-bound terrace visible on aerial photographs, but which has now been destroyed by ploughing and seabank construction. It is probably of 17th/18th century date.

- Surface 4 is a terrace of the Awre Formation of late 19th century date.

- Surface 5 is the youngest unit and is underlain by the Northwick Formation, up to 2m thick.

6.5.9 A series of boreholes were also taken by Allen which showed that there are two deposits of alluvium underlying Surfaces 1 and 2. Unit 1 is 10-15m thick and is overlain by a peat. This is earlier than Unit 2 which is *c.*10m thick and of different lithological character. Unit 3 underlies Surface 3 and is identified as the Rumney Formation. This has cattle footprints preserved in its surface and probably dates to the 17th/18th century.

6.5.10 Allen and Fulford (1990a) also identified three early reclamations at Arlingham. Reclamation I is of 185 ha and has been ascribed a Roman date, based on differences in height between it and the present-day saltmarsh. Reclamation II is given a more definite Romano-British date, based on finds of this date recovered from within it. Reclamation III measures 68ha and is also ascribed a Romano-British date based on height differences. Reclamation IV measures 55ha and has extensive ridge and furrow: the area is described as one of the most remarkable, although rapidly disappearing, displays of ridge and furrow in the inner Severn Estuary. It is argued that this is not an early medieval phase of reclamation, but that it is Romano-British in date, based on elevation differences. Reclamation V covers 5.2ha and was in existence by 1725 and is probably early-modern in date. Reclamation VI has been extensively eroded by the westward migration of the river channel and appears to have been constructed between 1802 and 1835.

6.5.11 Allen (2002) identified a series of stratigraphic units within the section at Hock Cliff, Fretherne and a settlement site within the ridge and furrow shown on aerial photographs. Three flints were recovered from the beach as were five sherds of Romano-British pottery and over 1,000 sherds of medieval pottery dating from the 11th to 15th centuries. Other finds suggest that at least one of the buildings identified at the settlement site was used as a dwelling.

6.5.12 Historic changes in the course of the river at Fretherne and Saul have been noted and a 17th century sea wall is still visible (Elrington & Herbert 1972, 165). Land deposited by the river, known as warths, were considered to be common land and in the 17th century a change in the river's course increased their area by over 80a. Trows were built into the 20th century at Sanfield Bridge and mariners are recorded in the parish between the 14th and 17th centuries (ibid).

6.5.13 The Severn has caused flooding in the parish of Frampton on Severn, notably in 1606 and in 1791 when 15 acres of the manorial estate were said to have been washed away (Elrington & Herbert 1972, 165). Land has also been added to the parish by the river: in 1615 *c.*30 acres were deposited and are known as Bromwich's Warth. A manorial fishery existed in the parish *c.*1225 when 6 fish traps were located at Buckpool. About 50 families in Frampton on Severn parish were employed on the River Severn in 1831 but the earliest recorded maritime activity is 1377, when a ship from Frampton was trading between Bristol and Ireland (ibid). A shipwright lived in Frampton in 1572 and a boatyard is recorded at Frampton Pill until the late 19th century. Frampton Pill was also used to land coal in the 17th century (ibid).

6.5.14 Allen (1986) claims that a total of 428ha has been reclaimed on Slimbridge Warth over the last 1000 years as a result of both natural and human action. He has also identified two areas of ridge and furrow on the estuarine alluvium which are enclosed by seabanks and two phases of sea defence at Slimbridge Warth. The first phase of defence occurred when Thomas Berkeley III enclosed 70 acres of marsh in 1335-6. The second phase is suggested from 18th century maps and the construction of a new sea bank in 1806 and another in 1884-6. Sea defences are shown on Isaac Taylor's 1777 map along the coast from Frampton Pill to Hock Ditch and also on the Commissioners of Sewers map of 1835, but these are gone by the 1886 OS map (ibid). This sequence appears to be supported by the stratigraphy of the area. Allen's suggested sequence is post-Roman use of the salt marsh for grazing, followed by medieval embankment and improvement of the soil for ploughing. Land was also subsequently reclaimed in the 18th and 19th centuries in this area.

6.5.15 Hewlett (1997) identified a sedimentary sequence at Slimbridge which was similar to that he identified at Longney (see above). Five pollen zones were identified here, the lowest being dominated by tree pollen, which is replaced by herbaceous pollen in the second zone, interpreted as the onset of wetter conditions associated with the deposition of sediment of a marine origin. The third zone sees an increase in *Chenopodiaceae* (goosefoot) pollen, which is common to some types of saltmarsh, which continues through the following zone, although brackish conditions seem to have withdrawn by pollen zone 4. The fifth pollen zone is dominated by Poaceae (grasses) and Cyperaceae (sedge) pollen. The pollen record at Slimbridge was different to that from the other sites studied and was the only one at which a definite marine influence could be observed.

6.5.16 To the south of Frampton on Severn, a timber structure was recently revealed by coastal erosion at Purton, interpreted as a track which was intended to improve access to fishing engines on Frampton Sand (Price and Spry 2004). This may, however, be a jetty or other structure (Wright 2004). NB There are two Purtons, on opposite banks in Gloucestershire (Figure 5).

6.5.17 Parker (1999) published the initial results from the recording of a series of old boats, used to reinforce the bank at Purton. A detailed plan with a standardised numbering system was produced and Parker suggested that this is used to refer to the boats in the future. The boats were deposited throughout the 20th century in order to protect the nearby Sharpness Ship Canal. Up to eighty vessels are present between Purton and Sharpness and these include examples of 19th and 20th century coastal, estuarine and inland waterways vessels. Further work has been carried out by local historian Paul Barnett (SMR 27217) and the Nautical Archaeological Society are currently recording some of the vessels. The vessels have elicited a great amount of local interest including the development of an active preservation society 'The Friends of Purton'.

6.5.18 The burnt-out wrecks of the MV Arkendale H and MV Wastdale H are visible at very low tide between Sharpness and Purton. These tankers, carrying diesel and petrol, collided on the night of the 25th October 1960, then hit a pier of the Severn Railway Bridge and exploded. The wrecks settled on the sand and the next day were blown open with high explosive and remain there today.

6.5.19 The Sharpness canal runs between Sharpness and Gloucester and was opened in 1827. A series of docks and associated buildings are still in use at Sharpness Docks: the Old Dock (1827) and the New Dock (1874) which are on opposite sides of Sharpness itself. The Old Dock has a towing horse stable, a tidal basin, a lock house, and the original entrance from the Severn to the canal. This was designed by Telford who collaborated with Mylne in completing the canal. The basin is small, and was never intended as a commercial dock. By 1869 congestion was such that a new and larger dock was essential. The Old Docks are now a leisure boat marina.

6.5.20 The New Docks were opened 25th November 1874 to improve the access to the Sharpness canal and thence to Gloucester Docks. A copy of a drawing by Loxton (dated to between 1885 and 1900) shows a high level swing bridge and a low level swing bridge and the outline of four large grain warehouses of which only the North Warehouse survives today.

6.6 Purton to Aust

SMP process Unit 9, Figure 4

6.6.1 South of Sharpness, the alluvial estuarine environment between Berkeley and Aust was surveyed by Allen (1992), who suggested that the process of reclamation here was begun in the Romano-British period, but that the defences visible today probably do not

correspond to the Romano-British ones. Ridge and furrow in this area shows that it was cultivated in the medieval period and appears to be of two phases: “older” ridge and furrow which is S-shaped and grouped into interlocking furlongs and “newer” ridge and furrow which is more regular and straight. Prior to the 1980s, when they were straightened, the sea defences along this stretch of coast were 20km long. These appear to overlie the ridge and furrow in some places, the result of it being “set back” in the 17th century due to coastal erosion.

6.6.2 The coast between Berkeley Pill and Oldbury-on-Severn (which includes Hills Flats and the area now occupied by the Berkeley power station tidal lagoon) has seen extensive archaeological work over the last 25 years.

6.6.3 A survey by Allen and Fulford (1987) located 2nd to 4th century pottery at Hills Flats and fieldwalking showed that material is more plentiful on the shore to the north east of Hill Pill. Other finds include iron slag and Old Red Sandstone blocks and Iron Age pottery was also recovered. Coastal erosion here has forced the mouth of the Hill Pill *c.*350m inland and tidal silts from the palaeochannel have produced 12th to 14th century pottery (Allen 1996). A quay and a fish trap have also been exposed by coastal erosion (Allen & Fulford 1996) and an assemblage of 277 post-Roman pottery sherds was recovered from an area at the mouth of Hill Pill, which appears to have been used as a landing place during this period (Allen 2003b). The assemblage is very similar in composition to material recovered from sites in Gloucester, Chepstow and Bristol.

6.6.4 Alex Brown (2005, 241) carried out an analysis of lithic material collected by Allen (1997d: see below) from Hill Pill, noting that there is an unusually high concentration of retouched pieces and cores. Brown also carried out palaeoenvironmental sampling at Hill and dated the peat here to 5300 ± 60 BP (4230 to 4000 cal. BC). Dendrochronological sampling of five oak timbers was also undertaken, unfortunately no dates were obtainable, but the wood was identified as predominantly oak (Timpany 2005, 308). Brown also found evidence for *in-situ* burning of the reedswamp during the Late Mesolithic period, but this was not associated with any stratified archaeological features or finds (Brown 2005, 268).

6.6.5 At Hill Pill a map of 1659 shows a seabank, embayed by 175m to a sluice, which still survives (Allen and Rippon 1995). Allen and Rippon (1995) argue that the defences here began to be constructed in the Roman period (based on settlement evidence 1km away and some material on the foreshore) but there is evidence for set-back due to erosion in the early 17th century. By 1835 the sluice had been moved 75m seaward on a line with the contemporary sea defences. These remained until the late 1980s when the 17th century bank was levelled and a new bank constructed further out and this was subsequently strengthened and straightened in 1991.

6.6.6 Over 2000 flints ranging in date from Mesolithic to Early Bronze Age were recovered from a considerable distance along the banks of a tidal palaeochannel at Oldbury-on-Severn (Allen 1998b). A sondage excavated into the peat revealed five stratigraphic units, Unit 3 being radiocarbon dated to 5310 ± 70 BP (4325 to 3984 cal. BC). This appears to have been a soil which was trampled by animals, including cattle (it is not stated whether these were wild or domesticated), deer and possibly humans and Brown (2005, 237) suggests that these are the earliest dated footprints within the Severn Estuary. Flint cores and blades were also recovered from this unit.

6.6.7 The best evidence for occupation in the area comes from the unpublished excavations and monitoring of the Silt lagoon at Oldbury Power Station undertaken by Avon County Council. Unfortunately these excavations were undertaken in adverse conditions and many features were not explored (Brown 2005, 238) although a total of 53 archaeological features including ditches, beam slots, pits, postholes and a palaeochannel were recorded (Hume 1992). The work produced flint and a structural timber dated to 3400 ± 45 BP (1748-1675 cal. BC) from a depth of c. 1.8m. The prehistoric deposits were located at the base of

the archaeological sequence on a clean fluvial sandbank or island and were overlain by in excess of 1m of archaeologically sterile alluvium the surface of which contained the structures and deposits of Roman date (A. Young pers. comm.).

6.6.8 Three Neolithic axes were found in this area by Allen in 1988-9 (Allen 1990a), two of which (one of Group VIII and one of Group XXI) were recovered from Oldbury Flats and found within metres of each other in a strew of bedrock debris and rounded pebbles. The other axe (of Group I) was found at Hills Flats in an area at the mouth of Hill Pill from which worked flints including barbed and tanged arrowheads, scrapers, knives and cores were recovered (Allen 1997c).

6.6.9 Druce (2001) sampled the peat at Oldbury as part of her PhD research. Five test pits were excavated and a series of peat layers identified and radiocarbon dated. The results from the pits show a number of spatial and temporal differences, with open birch (*Betula*), hazel and oak woodland present prior to 5500 cal. BC. Conditions became wetter, probably as a result of rising sea-level by 4500 cal. BC. During the late Neolithic, conditions became fully marine with no further peat being deposited after *c.*2500 cal. BC. Further work was carried out on the peat deposits at Oldbury by Brown (2005) who suggests that sea-level began to rise here *c.*5500 to 5150 cal. BC, followed by the formation of the peat deposits. Brown (2005, 222) also recovered further lithic material at Oldbury, alongside evidence for burning of the reedswamp during the Mesolithic period. The following sequence was suggested by Brown (2005, 234-239): prior to 5550 cal. BC there is no direct evidence for human activity, although there is a possibility that some of the lithics recovered from Oldbury may date to this period. Between 5500 and 4000 cal. BC burning of the reedswamp was carried out, which appears to be associated with lithics, probably in the late summer. Between 4000 and 3100 cal. BC the wetland continued to be exploited until peat formation ceased (implying a marine transgression) *c.*2840 to 2138 cal. BC. The fringes of the saltmarsh continued to be used during this period and the area appears to have been grazed by cattle.

6.6.10 At Oldbury Flats, Allen and Fulford (1987) recovered 2nd to 4th century pottery, along with iron slag, a piece of flue tile and animal bone, from around the southern tip of the reservoir. Similar pottery, animal bone and a bow brooch were also recovered during earth moving operations at The Windbound Inn, Shepperdine. At Oldbury Pill, iron slag, Romano-British pottery and burnt iron ore were recovered from an area to the south west of the Yacht Club. A stone shaft has also been recovered from the edge of the saltmarsh at Oldbury Flats and has been interpreted as being of Roman date and part of a high-status building, matching the finds of flue tile and *tegula* from this area (Allen and Rippon 1997). Allen and Fulford (1992) argue that these scatters of occupation debris, coupled with stratigraphic analysis, imply that reclamation took place here in the Roman period.

6.6.11 Pottery recovered from an area of ridge and furrow at Home Farm, Oldbury-on-Severn also included Romano-British and medieval material (Allen 1997c). The Romano-British pottery mainly dated from the mid 3rd to mid 4th centuries and there was nothing older than the 2nd century. Pottery, iron making materials and fire cracked stone were recovered from Dayhouse Farm, Hill. The pottery included Romano-British material of 3rd to 4th century date. Waste materials from iron making were also present here. At Nupdown Farm, Hill, 11th to 13th century pottery was recovered and similar dated material was found at Home Farm, Oldbury-on-Severn.

6.6.12 Allen (2005) identified eight fish traps visible on aerial photographs on Oldbury Flats and suggested that a group of features at Horse Pool may be of a kind unique to the Severn.

6.6.13 The setting-back of the coastal defences of the Severn in the early modern period is apparent as defences overlie ridge and furrow which is visible both on aerial photographs and on the ground. Allen and Fulford (1992) identify four areas around Oldbury where this has taken place: between Cowhill Pill and Oldbury Pill; along the banks of Oldbury Pill and

Oldbury Village; at the mouth of Oldbury Pill on its north east end and to the south east of Oldbury Flats. This setting-back probably occurred in the early 17th century and is associated with the deposition of the Rumney Formation on the abandoned fields. There is no set-back downstream for Cowhill Pill or upstream from Oldbury Pill.

6.6.14 Recent work in the area between Oldbury and Aust has uncovered a new Roman settlement site and part of a minor Roman road close to the foreshore at Cowhill and further evidence of the Roman settlement at Aust first identified by Solley (1966), also close to the estuary foreshore (A. Young pers. comm., forthcoming)

6.7 Aust to Portishead

SMP Process Units 7, 15 and 16, Figures 7 and 8

6.7.1 The intertidal features between Aust and Beachley were surveyed by Allen (2003a), who pointed out the lack of archaeological work on Severnside waterfront features associated with ferries and other trades. Cole (1912) also notes the Binn Wall, which runs south from Old Passage for *c.*1.5km, as being the most impressive piece of coastal defence work on this stretch of coast, measuring *c.*5m high and built in 1816-18. This feature is recorded as the Byndwall from at least 1646 (ibid).

6.7.2 Extensive archaeological work took place to the south of Aust in advance of the Second Severn Crossing in 1992-4, much of it inland of the RCZA survey area. The initial phases of work were undertaken by Glamorgan Gwent Archaeological Trust (Lawler *et. al.* 1992). Later work included excavations by Wessex Archaeology, summarised by Gardiner *et al.* (2002). At Hallen, two Iron Age structures were the first to have been discovered on the Avon Levels. These were revealed as three islands of *in situ* deposits, extending over 60m. Underlying these were two post-built round houses within small enclosures, separated by a small stream. Pottery (a significant proportion of which was non-local), animal bone and smaller quantities of fired clay, worked stone and worked bone were recovered with occupation occurring over the 2nd-1st century BC. No quern stones were found on site and there was very little evidence for the presence of crops or crop processing in the environmental samples. The environmental sequences suggested that the site was initially a stable saltmarsh edge, following which there was a period of either negative sea-level tendency or marsh outgrowth during which period the vegetation resembled pasture, followed by increasing sea-level/marsh retreat. Sheep bone dominated the faunal assemblage but cattle and pig were also present. The site was interpreted as a short lived, seasonally occupied site used for grazing sheep and cattle.

6.7.3 A 1st century AD field system was excavated at Northwick, which was again in use for a short period and probably represents small paddocks or enclosures.

6.7.4 Environmental sampling in the wider landscape revealed fresh water peats at Awkley Lane which were dated to 4500-2600 cal. BC and further peat deposits at Vimpenny's Lane (west of Compton Greenfield) dated to 2920-2610 cal. BC. These results, along with those from a series of machine-cut test pits at Awkley Interface and an auger survey, allow a detailed understanding of the Holocene-Flandrian sedimentation of the Avon Levels. The regional vegetation was greatly affected by changes in sea-level: increasing sea-level resulting in the formation of the Lower Wentlooge Series and negative sea-level change in the accumulation of peat within a fen carr environment. An "Upper Wentlooge transgressive event" has been identified across the Severn Levels and this occurred at Vimpenny's Lane and Awkley Lane at *c.*2550 cal. BC. A further event, marking the change from the peat of the Middle Wentlooge to the estuarine sediments of the Upper Wentlooge formations, occurred *c.*390-110 cal. BC. This work also allowed the model for the ways in which the Avon Levels were exploited in Late Prehistory devised by Locock (2001a) to be revised and expanded.

6.7.5 Druce (1998, 2001) carried out work at Gravel Banks, to the south of the Second Severn Crossing. The site was located *c.*1.5km offshore from Chittening Warth where the peat is only exposed at low spring tides and there is also a submerged forest. Two layers of peat were analysed, the upper layer at -2.86m and the lower at -3.98m OD. The upper peat was dated to 6620 ± 70BP (5667 to 5472 cal. BC) and 6460 ±70BP (5553 to 5307 cal. BC) at its base and top, the lower peat to 7150±70BP (6211 to 5892 cal. BC) and 6440 ± 70BP (5573 to 5234 cal. BC) at its base and top. The lower profile of the peat here was divided into three zones, mainly consisting of tree pollen, suggesting the site was located close to woodland. The upper profile is also dominated by tree pollen, except at the very top of the column, where herbaceous pollen dominates.

6.7.6 Druce's work, and that carried out by others in the area, suggests an inundation *c.*6000BC, followed by sea level rise which is followed by a short-lived regression and subsequent inundation *c.*4000BC. The Avonmouth Levels are described as a highly complex area of mudflat, saltmarsh, reedswamp and raised bog during the Neolithic, which may have been periodically inundated. There was some stabilisation in the Bronze Age/Early Iron Age, but this does not appear to have been long lasting or widespread. There is some evidence of Romano-British use of this area which is connected to occupation of the "dry land" further from the coast.

6.7.7 Allen (2005) identified a total of ten fish traps visible in aerial photographs in the area around Gravel Banks and Riley (1999) recorded the locations of peat and submerged forest deposits here.

6.7.8 Slightly to the south of the areas excavated in advance of the Second Severn Crossing, sediment stratigraphic and palaeoenvironmental analysis was undertaken from 6km of a pipeline across the Avonmouth Somerset levels between Almondsbury and Seabank (Carter *et al.* 2004).

6.7.9 Charcoal from a feature below the alluvium at Easter Compton (also now well inland) was dated to 3550-2900 cal. BC and was associated with two flints. The lowest levels of peat at Marshwall Lane lay at 3.6m OD and were dated to 2700-2460 cal. BC and the upper levels to 2470-2190 cal. BC. The peat appears to have developed under fresh water conditions in an alder carr environment. Evidence for mixed woodland was also recovered. At Field 182, an organic silty clay within the peat at –5.56 to –5.63m OD also suggested a freshwater environment with pine, oak and hazel woodland, probably of early Holocene date. Peat in Field 186 at –1.35 to –1.45m OD had evidence for alder carr environment and local woodland of oak and hazel. This continued, with local fluctuations in alder and willow pollen, through the peat sequence, the upper level of which was at 2.06m OD. Above the peat evidence for a saltmarsh environment was recovered.

6.7.10 Excavations at Farm Lane (Field 136B, the lane runs south east from Severn Beach) recovered evidence of a buried soil at 4.20m OD, dated to 3300-2200 cal. BC, but this work also indicated problems with dating buried soils in the area. The soil appears to have formed prior to the onset of rapid deposition of alluvial silts and pollen analysis showed that it developed below herbaceous vegetation cover with freshwater fen on the landward side. It was suggested that the presence of "disturbance indicators" indicates that this area was used for (perhaps seasonal) grazing. Further excavations at Farm Lane, published by Masser *et al.* (2005) recovered evidence for a pair of parallel ditches which contained mid-2nd Century AD pottery and further material of this date was recovered from a series of pits and ditches. Features dating to the 3rd to 4th centuries AD were also excavated, but there was no evidence to suggest that the site was occupied beyond 350 AD. The environment during the 2nd century appears to have been open grassland with probable cereal cultivation and animal grazing nearby. By the end of the 2nd century, the site appears to have been occasionally inundated by the tide. Remains of wheat, barley and oat were recovered from the 3rd to 4th

century deposits at the site, when the environment appears to have been open, disturbed grassland with few trees.

6.7.11 Excavations in advance of the expansion of a sewage treatment plant at Avonmouth (Allen *et al.* 2003) revealed evidence for a Mesolithic saltmarsh environment which was subject to later alluviation. A deposit above this alluvium contained Late Bronze Age pottery and charcoal of oak, ash, elm and hazel as well as maple, yew, hawthorn and briar, interpreted as firewood charcoal. Charred plant remains included wheat and barley and imported stone and animal bone were also recovered. This deposit was dated to 1070-810 cal. BC and 1380-1010 cal. BC and was sealed by over a metre of alluvial clay. Two medieval (*c.*13th century) ditches and three post-medieval ditches were also excavated here.

6.7.12 At Cabot Park, north of Avonmouth (Locock 2000a), there are a complex sequence of horizons, the lowest of which, dated to *c.*2500 cal. BC, is known as the *BaRAS Layer*. This layer appears to represent a saltmarsh environment with nearby woodland. A second soil layer, dated to *c.*1500 cal. BC, was recorded and evidence for nearby hazel woodland was recovered from within it. A further upper gleyed horizon was radiocarbon dated to 1120-910 cal. BC. Archaeological deposits from this area include a dense scatter of burnt stone identified at Little Googs; a spread of charcoal dated to 910-424 cal. BC at Kites Corner and three spreads of charcoal, burnt stone and Late Bronze Age pottery at Stinkums (Locock *et al.* 1999). A site at Kites Corner produced a range of Mid/Late Bronze Age radiocarbon dates and evidence for burning, alongside cattle, fish and deer bone and probably locally produced Late Bronze Age pottery (Locock 2001b). Medieval and post-medieval material has also been recovered from the area around Rockingham Farm (Locock 1998).

6.7.13 Excavation was undertaken at Seabank in advance of the development of a power station in 1995 (Insole 1997). Organic deposits were recorded in the Upper Wentlooge Formation at 4.32 to 4.04m OD and these were radiocarbon dated to 2290-2030 cal. BC. The peat contained plant macrofossils including rush, water plantain, bulrush and other marsh species. A series of ditches, probably representing a field boundary, were also excavated and found to date to between the 11th and 14th centuries. Further work on the route of a pipeline between Pucklechurch and Seabank (Masser *et al.* 2005) revealed further evidence for Romano-British occupation at three sites. At Lower Knole Farm, a buried land surface containing Roman coarse-ware sherds was cut by a ditch, both of which were sealed by a thin layer of blue clay and a thicker layer of pinkish-brown clay which contained sherds of a 1st century AD tankard.

6.7.14 At Crook's Marsh, Romano-British occupation dating to the late 4th to early 5th century was identified by Everton and Everton (1980). Further work by Masser *et al.* (2005) revealed three ditches containing 3rd to 4th century pottery and environmental evidence recovered from their fills suggests that there was an open environment at the time and that wheat and barley were grown and processed in the vicinity. An analysis of diatoms and foraminifera from the ditches suggest that they were flooded by salt water whilst they were open.

6.7.15 The archaeology associated with the construction of the Royal Edward Dock, Avonmouth (which included human remains and a Bronze Age rapier), was discussed by Brett (1997) but little archaeological work appears to have been undertaken in the Avonmouth, Portbury and Portishead dockland areas although due to current expansion plans much development led work is likely to be undertaken in the future. The coastal strip between Avonmouth and Clevedon has attracted little research.

6.8 Portishead to Brean Down including Steep Holm

SMP Process Units 17-22, Figures 8 and 9

6.8.1 The landscape development of the Gordano Valley area has been summarised by Jeffries *et al*. (1968) and Gilbertson *et al.* (1990) sampled buried peat in the valley, which covered the whole of the Holocene, ranging in date from 11,020 ± 190BP to 3820 ± 100BP (9260-1770 cal. BC). A total of 9 pollen zones were identified which indicated a change from a cold, sub-artic environment, the arrival of oak and elm and the development of a mixed oak forest and the introduction of cereal crops.

6.8.2 To the south of Clevedon, worked flint including material of Upper Palaeolithic, Mesolithic and Neolithic date, as well as flakes and cores, were recorded at Blackstone Rocks (Sykes 1938). Hilditch (1998) carried out a rapid survey of the coastal archaeology between Wains Hill, Clevedon and Sand Point, Worle, where analysis of aerial photographs suggests that mud cover is decreasing and that erosion is taking place immediately in front of the sea wall. The majority of the sites found during the survey were fish traps and poorly defined scatters of stakes without apparent function. Also identified were a series of target vessels used for the firing range off Kingston Seymour, as well as a number of recent bomb craters and stacks of bombs ready to be destroyed.

6.8.3 The River Banwell, which enters the Severn in Woodspring Bay, was surveyed by Allen (1997a) who mapped and investigated the location of the seabanks here. The oldest seabank located ran at least as far as the bridge at Ebdon and also extended up the Sand, Kewstoke and Northfield Rhynes. The date of this defence is uncertain, but it appears on a map of 1738 (BRO 04480) and is assumed to be medieval in date, perhaps having been constructed by the Augustinian community at Woodspring Priory, which was established in 1226. These defences have subsequently been increased in height and width and their modern form is a result of work in 1990. The seabanks were also shortened: the moving of an outfall at Ebdon in *c.*1790 shortened the banks by *c.*3300m.

6.8.4 The coast to the south of Sand Bay is dominated by Weston-super-Mare and little archaeological research has taken place along this stretch of coastline. The intertidal zone is over 2km wide in this area, but has never been systematically surveyed presumable due to the dangers of the mobile mud banks.

6.8.5 The island of Steep Holm lies 9km off Weston-super-Mare and 5km from the tip of Brean Down. The island has a Viking presence and a 12th-13th century priory. There are also Victorian military works and extensive WWII structures.

6.8.6 Stan and Joan Rendell have undertaken archaeological research and fieldwork on the island since 1978 (see Rendell & Rendell 1993b). Several hundred flint and chert flakes have been recovered from the excavations at the priory site. The Victorian infill of the priory site contained at least one La Tene III brooch and a “Celtic” carved stone head has also been found on the island (Green 1993). Roman pottery has also been found across the island and this is suggested to have been associated with a possible Roman signal station indicated by a circular earthwork at the west end of the island from which Roman pottery has been recovered (but which has also been described as a Bronze Age barrow or Viking defensive work).

6.8.7 Field boundaries on the island have been surveyed (Rendell & Rendell 1993a) and have been suggested to be probably medieval in origin. Small scale excavations have taken place on the site of the priory and its associated cemetery. Subsequent to the Dissolution the island was used as a rabbit warren by the Lords Berkeley and a tenement for fishermen was constructed in 1776.

6.9 Brean Down

SMP Process Units 21 and BURN, Figure 9

6.9.1 Martin Bell carried out a series of excavations at Brean Down between 1983 and 1987 (Bell 1990), the earthworks on the Down were surveyed by Riley (1996) and subsequent archaeological work has been undertaken by Allen *et al.* (1997).

6.9.2 The excavations carried out by Bell were largely in response to coastal erosion, which revealed two Late Bronze Age gold bracelets, pottery and human bone (Bell 1990, 3-8). Prior to this, erosion had also exposed a pit on the foreshore which contained sherds of at least two Beakers and charcoal (Taylor & Taylor 1949), subsequently radiocarbon dated to 3460 ±80BP (2012 to 1537 cal. BC: ApSimon 2000). Bell's excavations focussed on an area of the sand cliff and revealed evidence for activity associated with Beaker pottery, followed by stone structures of Bronze Age date associated with biconical urns and Trevisker ware. Evidence for cooking, weaving and occupation was associated with these structures and there was a small-scale salt extraction industry at the site. The gold bracelets were recovered from a deposit which also contained Late Bronze Age plain ware, sealed by a sand into which a series of sub-Roman graves were cut. Extensive environmental sampling was also undertaken at Brean Down and showed evidence for limited cereal production but the exploitation of the surrounding area for grazing cattle and sheep. Subsequent archaeological evaluation along the sand cliff at Brean Down (Allen *et al.* 1997, Locock & Lawler 1996) recovered further Beaker and Romano-British pottery, including a Dressel 20 amphora. The environmental sequence indicated a lagoon/saltmarsh at the base of the sequence, overlain by a Bronze Age deposit containing pollen of plantain and grasses with sedges and bracken with some birch, pine, oak and ash present. The Romano-British environment appears to have been dry pasture but the evidence was poorly preserved.

6.9.3 On the ridge above the sand cliff, nine Early Bronze Age round barrows were identified by Grinsell (1971) and two field systems were surveyed by the Royal Commission (Riley 1996). Near the east end of the Down is an Iron Age hillfort, which was partially excavated by Burrow (1976), and a Romano-Celtic temple is located nearby (ApSimon 1965). At the west end of the Down is a large Palmerstonian fort, built in 1870 and re-armed in World War II, when it formed part of a coastal battery (Riley 1996, 19). Features are also known from the coastal zone at Brean Down and include stone and timber fish weirs, structures of a possible military function and an exposure of peat, radiocarbon dated to 5620 ± 100BP (4707 to 4268 cal. BC: Bell 1990, 104).

6.10 Brean Down to Hinkley Point

SMP Process Units BURN and PARR, Figures 10 and 11

6.10.1 The coast between Brean and Berrow, at the mouth of the River Parrett, is backed by dunes which have been recorded since at least 1301 (Rippon 2001b), but no archaeological work appears to have taken place in the intertidal area here, apart from some environmental sampling by Druce (2001) at Burnham-on-Sea. A total of three layers of peat were recorded at –0.01m, -2.89m and –3.10m OD, the top of each of these layers was dated to 4790 ± 70BP (3699 to 3375 cal. BC), 5590 ± 70BP (4587 to 4274 cal. BC) and 6340 ± 70BP (5478 to 5081 cal. BC). The base of the uppermost peat was also dated to 5370 ± 70BP (4346 to 4005 cal. BC). Pollen from the lower profile was divided into 5 zones, showing an early transition from lower to higher saltmarsh conditions, followed by brackish/freshwater and subsequent possible shift in the climate *c.*6340-5590 BP. Both the pollen and the foraminifera showed a regressive regime prior to the formation of the lowest peat layer. A return to reedswamp appears to explain the formation of the middle peat layer.

6.10.2 The upper pollen profile was divided into four zones showing saltmarsh, possibly close to a shingle shoreline, then a return to reedswamp conditions. Charcoal was also noted throughout the profiles, with a slightly higher density in the upper sequence, possibly indicating an increase in burning around 5370 ± 70BP (4346 to 4005 cal. BC). Evidence from the surrounding area suggests that a regression took place *c.*4/4500 BC, leading to the formation of reedswamp and saltmarsh and an oak fen at Stolford (west of Stert Flats). After 4/3000 BC, sea level appears to have risen, leading to a fen carr environment.

6.10.3 A local archaeologist and historian, Samuel Nash, observed 100 sites in Burnham on Sea as a result of his monitoring of building work, quarries, service trenches and road construction between 1956 and 1978 (Rippon 1995a). Nash recorded a tidal creek to the south of Highbridge and another to the south of Brent Knoll (the proto-Brue and the Siger). Roman occupation is known from along the banks of both of these rivers, but much of this is outside the RCZA survey area. The site closest to the coast, at Marine Drive, provided evidence of Roman occupation. Other sites in this area form part of a wide distribution of Roman salt production sites in the Somerset Levels, particularly in the Brue Valley.

6.10.4 The area of Bridgwater Bay at the mouth of the River Parrett has an extremely complex development, summarised by McDonnell (1993, 1995a, 1996 and also see Carr 1971). McDonnell's work was part of a survey of Bridgwater Bay carried out by the Royal Commission on Historic Monuments and covered 36km^2 . A total of 77 records were created as a result of the survey, but complex sites such as fishing grounds, which may have been composed of up to a hundred weirs, were allocated a single number. Nearly half of these records related to sites or structures which were designed to operate in an intertidal context and a third of all the records were originally from dry land contexts but had been deposited in the intertidal area by geomorphological movement or rising sea level. Peat deposits and a submerged forest were also identified off Stolford and these were dated to *c.*2500BC and *c.*6500 BC. The archaeology was noted as being fragile and subject to erosion: vulnerable sites (consisting of over half of those recorded) could easily be destroyed by a single storm event.

6.10.5 McDonnell (1996) also used cartographic, hydrographic and documentary evidence to construct the evolution of islands in the mouth of the Parrett (Slab Island, Dunball Island, Fenning Island and Stag Island), which have changed considerably over the last several hundred years. Carr (1971) also documented erosion over the last 150 years at Steart, but noted recent accretion between Wall Common and Fenning Island. Annual monitoring of Stert Island by the Nature Conservancy since 1957 has shown that the island has stopped its extension northward and southward, but erosion is more marked on the steeper, eastern side rather than the more exposed western side.

6.10.6 The only published dates for fishing structures in the English Severn Estuary are currently from Bridgwater Bay, where wood samples from 15 structures on Stert Flats were submitted for dendrochronological analysis. Only two timbers were successfully dated with felling dates of AD932 and AD966 (Groves *et al.* 2004). Several wood samples were dated on the Welsh side of the Second Severn Crossing (Godbold & Turner 1994) and found to date from possibly as early as the 8th century up to the 17th century. Recent work in Stert Flats has identified four major types of fish weir and produced radiocarbon and dendrochronological dates indicating their construction from the 10th to 17th centuries (Brunning forthcoming). Repairs on some structures continue to the present day.

6.10.7 Bridgwater Bay was central to the development of models for sea-level change in the estuary, in particular Kidson and Heyworth (1973) carried out sampling of submerged forest and peat deposits in the Bay and produced a map of their own boreholes and those taken by Soil Mechanics Ltd for the M5 and by the Somerset Rivers Authority. The peat in the Bay ranges in date from *c.*3000BP in front of the storm beach to 7000BP at Low Water Mean Spring Tide. The basal peat overlies the Lias bedrock and is itself overlain by estuarine

clays. This terminates in the “OD clay” on which are developed horizontal peats, in places interrupted by more clay.

6.11 Hinkley Point to Gore Point

SMP Process Units LILS, WATC, MINE and PORL, Figures 11 to 13

6.11.1 Hinkley Point forms the westerly boundary of Bridgwater Bay and the coast between Hinkley Point and Blue Anchor Bay is predominantly rocky. Fish weirs are known off East Quantoxhead (Somerset HER 33776) and in St Audrie’s Bay (Somerset HER 34711) but little archaeological work has been carried out along this stretch of coast, which includes the harbour at Watchet.

6.11.2 Palaeolithic material is known from the Watchet area and material of a similar date is visible in the cliff section at Doniford.

6.11.3 As part of the archaeological mitigation of the works associated with coastal defences on Minehead beach, 7.56ha of peat, submerged forest and other features including two wrecks were surveyed and sampled (McDonnell 2002a; Jones *et al.* 2005). Two main peat forming periods were identified in the Late Mesolithic and pollen, macrofossil and insect assemblages were analysed. Microliths have been found on the foreshore at Minehead (Boyd Dawkins 1870) and there is also abundant charcoal, suggesting burning of the reedswamp/alder carr in the Mesolithic period.

6.11.4 The only fish weirs in the RCZA survey area protected as Scheduled Monuments are located off the beach at Minehead (SM no. 33730). These are of stone construction and are recorded as “Four medieval wish weirs 500m east of the harbour”, although the Somerset HER mapping (PRN 33348) suggests that more than four weirs are present in the Scheduled area, with many more in the surrounding area.

6.11.5 A submerged forest has been known at Porlock since at least the 1830s (Boyd Dawkins 1870) and worked Mesolithic flint has been found associated with this throughout the 19th and 20th centuries.

6.11.6 Porlock Bay was extensively surveyed by Canti *et al.* (1996) in response to the threat of marine incursion through the shingle ridge of the beach and subsequent erosion of archaeological features and the submerged forest. Mesolithic material is recorded from the intertidal zone and from the eastern end of the lagoon behind the shingle ridge. Other material recorded in the intertidal zone included stone built fish weirs and pillboxes; lime kilns were also recorded on the foreshore.

6.11.7 A programme of coring was also carried out to examine the stratigraphy and palaeoenvironment. Sediments reach a depth of more than 9m in the area surveyed and peats are recorded from –5.5m, -2.5m and –1.25m OD. More detailed palaeoenvironmental work on the same sequence was published by Jennings *et al.* (1998) who recorded the results from a total of 71 logged cores, 17 radiocarbon dates (mostly from organic/silty clay contacts), four pollen diagrams and one diatom diagram (with supplementary biostratigraphic data obtained from spot sampling) from the intertidal area at Porlock.

6.11.8 Thin organic beds were found in two stratigraphic contexts on Porlock Marsh; first, intercalated with the fine clastic sediments, and second, as thin basal deposits overlying solifluction material. The organic beds are found at depths from approximately -0.5 m OD to -8.7 m OD, and are older than *c.* 5700 cal. BP (3750 cal. BC). From the radiocarbon results and the stratigraphic context of the organic beds, it appears that there were three periods of organic deposition; at *c.* 8300–7900 cal. BP (6350-5950 cal. BC), *c.* 7400–7200 cal. BP

(5450-5250 cal. BC) and the most recent period bracketed by the dates 6450 to 5490 cal. BP (4500-3540 cal. BC) i.e. through the Late Mesolithic and Early Neolithic.

6.11.9 The pollen assemblage from the Marsh indicated a rapid succession from salt marsh through to a brackish to freshwater stage dominated by sedge with pondweed and rushes. Four local diatom assemblages were also identified in the Marsh: an initial fresh water assemblage at the base of the sequence, followed by a rise to dominance of marine and brackish water diatoms to *c.*60% of the sum, but with a significant freshwater component. The marine and brackish water taxa together rise to values of *c.*70–75% of the sum in the third zone, followed by a freshwater assemblage of diatoms.

6.11.10 Radiocarbon dating and biostratigraphic analyses of the submerged Forest Bed suggest as many as six periods of organic deposition alternating with fine clastic sedimentation, in addition to 'basal peat' development, between 8463 cal. BP and 5821 cal. BP (6514-3871 cal. BC). Two, possibly three, of these periods may be contiguous with organic beds below the marsh.

6.11.11 Pollen analysis here revealed two zones: a lower zone with reduced Alder and high ferns, succeeded by a zone dominated by Alder. A further pollen column from the Forest Bed showed an initial succession from a brackish, probably high salt marsh environment dated to 5931–5658 cal. BP (3981-3708 cal. BC), followed by the establishment of a Willow dominated carr and finally the return to more brackish (salt-marsh) conditions. The most extensive of the four pollen diagrams covers the period from approximately 8500 cal. BP (6550 cal. BC) to soon after 7207–6864 cal. BP (5257-4914 cal. BC) and shows an initial phase of pine, oak and hazel *c.* 8559–8375 cal. BP (6609-6425 cal. BC), probably close to a salt marsh with tidal channels. This is followed by the rapid establishment of an alder carr environment until *c.*7937–7727 cal. BP (5987-5777 cal. BC) when salt marsh and tidal channels became established due to a transgressive marine event. The final part of the pollen column showed that alder carr conditions returned *c.* 7207–6864 cal. BP (5257-4914 cal. BC) but that this may have coexisted with a salt marsh environment.

6.11.12 Analysis of Relative Sea Level Rise showed an early Holocene (*c.*9000 cal. BP – *c.* 7050 cal. BC)) rate of rise of *c.*16mm per year. By *c.* 7500 cal. BP (*c.*5550 cal. BC), this had slowed to *c.*8.5mm per year punctuated by a period *c.*8000 cal. BP (*c.* 6050 cal. BC) where the rate was as low as 1.5 to 3.4mm per year.

6.11.13 The following analysis of the sequence at Porlock was offered:

> During the early Holocene (*c.* 10 000 to 8500 cal. BP – *c.* 8050 to 6550 cal. BC), much of the present coastal area was landward of the transgressing shoreline. By *c.* 8500 cal. yrs BP (*c.* 6550 cal. BC) the first signs of advancing marine conditions are recorded, as is the first instance of alder carr. Soon after 7937–7727 cal. BP (*c.* 5987-5777 cal. BC), a marine transgression converted the site to salt marsh with tidal channels. The high-energy shoreline at Porlock was seaward of the present MLWST mark, and probably comprised a gravel barrier, which was able to undergo episodes of consolidation and perhaps growth, resulting in the establishment of alder/willow carr and organic deposition in freshwater, back-barrier areas.
>
> From *c.* 8500 cal. yrs BP to *c.* 6000 cal. yrs BP (*c.* 6550-4050 cal. BC) the position of the shoreline (as measured by the landward limit of salt marsh/mudflats) oscillated as tidal inlets opened and closed. When the inlets were open, the marine limit was landward of the present beach. This pattern continued until around 6000 cal. yrs BP (*c.* 4050 cal. BC) when a high-energy event terminated the last alder carr recorded in the Porlock marsh area.

6.11.14 McDonnell (1995b, 1998, 2002a & b 2003a & b, 2004, 2005) has carried out regular monitoring of Porlock Beach following the breach of the shingle ridge in 1996, on

behalf of Exmoor National Park Authority. Features revealed include the drainage system of the former pasture fields, palaeochannels, former land surfaces, wooden structures and the partial skeleton of a Bronze Age aurochs (Mc Donnell 1998, Straker *et al.* 2004).

6.11.15 A piece of worked timber was found in an intertidal channel on Porlock Marsh in 2003 (McDonnell 2003a). This is a roughly hewn, radially split oak plank with two mortices cut through its thickness. The wood was radiocarbon dated to 780 to 1020 cal. AD and is the second timber with mortices to be found on the marsh.

7 HER/SMR, NMR and other datasets

7.1 Summary

7.1.1 Tabular and spatial data for the RCZA area were collected from Gloucestershire, South Gloucestershire, Bristol, North Somerset, and Somerset HER/SMRs (Figure 14) and was loaded as a set of ArcGIS layers within the project GIS. The NMR archaeological database was also queried and incorporated into the GIS. As the different counties utilised different GIS and HER databases, the complete HER/SMR data was not used for the survey, but the following fields were requested from each HER/SMR and incorporated into individual databases:

Name

SMR/HER Number

Grid Reference

Date

Period

Description

Word files containing text descriptions of each site and their bibliographical references were also requested.

7.1.2 In total 4,095 records were returned from the SMR/HERs within the survey area and 1,402 from the NMR database. These were provided in a range of formats, dependent on the particular system used by each HER/SMR and no two sets of data were identical. The data was "cleaned" as far as practicable, but no attempt was made to check its accuracy. As a result the data used by the RCZA cannot be regarded as definitive. There are also large overlaps between NMR and SMR/HER data, but again no attempt was made to clean the data.

7.1.3 A significant problem encountered when trying to utilise this data is that it is impossible to assess how representative or significant the sites within the RCZA survey area are. For example, there are numerous medieval sites along the Somerset coast, but it is impossible to know if this represents a significant part of Somerset's medieval archaeology or only a small, insignificant proportion of it. Furthermore, concentrations of records may often reflect where recent development led archaeological work has been carried out, often in current urban areas, rather than reflect the true distribution of archaeological sites and deposits.

7.1.4 The nature of the data collected from the NMR and HER/SMRs means that only broad concentrations of sites and monuments can be identified, rather than important single sites. Single sites are, however, considered in the preceding discussion of the archaeology of the estuary.

7.1.5 Shapefiles and datasets will be made available to researchers. It should be remembered that datasets are incomplete and were collected in 2006. Updated data will be requested in advance of future fieldwork phases of the RCZA.

7.1.6 The NMP mapping of information from aerial photographs carried out during Phase 1 of the RCZA has resulted in the identification of numerous new sites and the revision of many known ones. At the time of writing this information has not yet been added to all County and Unitary Authority based databases. It is therefore essential that NMR data is collected if an up to date record of known sites is to be examined for any project within the RCZA survey area.

7.2 Prehistoric

7.2.1 A total of 348 records for the prehistoric period are present within the data collected for the RCZA survey area. Some of these data, however, represent “natural” deposits such as outcrops of peat or palaeochannels (Figure 15).

7.2.2 The prehistoric period is poorly represented on the right bank of the Severn, with a single Bronze Age burial at Tidenham representing the only *in-situ* archaeological deposits excavated in this area. Flint finds of prehistoric date have been recovered from fieldwalking at Warren Farm, Lydney; Elton Farm, Elton and from close to the foreshore at Gatcombe. Earthworks at Naas Cliff have also been identified as possibly relating to an Iron Age enclosure.

7.2.3 The left bank of the river has seen more archaeological work and lithic implements dating from the Mesolithic to the Early Bronze Age have been collected from the Arlingham area; the foreshore at Oldbury; the Portishead area; Sand Point; Uphill; Kilve; Old Cleeve; West Quantoxhead; Minehead and finds of Mesolithic worked flint have been recovered from the submerged forests at Minehead and Porlock.

7.2.4 A series of important Palaeolithic finds were made in the Avon valley, but many of these lie outside the RCZA survey area. Palaeolithic material is also known from the Watchet area and Palaeolithic material is visible in the cliff section at Donniford.

7.2.5 The Bronze Age is relatively poorly represented, with the round barrows at Pixie’s Mound, Stogursey and at Sand Point representing the upstanding archaeology of this period. Middle to Late Bronze Age occupation deposits were excavated at Brean Down, where there are also possible round barrows and apparent settlement evidence was recovered from the silt pond at Oldbury Power Station.

7.2.6 Iron Age material has been excavated from Avonmouth Levels, in advance of the construction of the Second Severn Crossing and Iron Age field systems and an associated banjo enclosure have been recorded from Walton Down. Iron Age material has been recorded along the ridge to the south west of Walton Down and also at Sand Point and Weston-super-Mare. Coastal hillforts are known at Clevedon, Worlebury and Brean Down.

7.2.7 The major concentrations of prehistoric material within the RCZA survey area can be summarised as:

- the Arlingham area (See 6.5.8 above, SMP PU 12).
- the foreshore at Oldbury (See 6.6.6-7 above, SMP PU9)
- the Avonmouth Levels (See 6.7.2-14 above, SMP PU7 and 15)
- the Portishead-Clevedon ridge (See 6.8.1 above)
- Sand Point, Worlebury and Brean Down (See 6.9 above, SMP Pus 19-21)
- Kilve to Old Cleeve (SMP PUs LILS and WATC)
- the submerged forests at Minehead and Porlock (See 6.11.2-3 above, SMP PUs MINE and PORL)

7.3 Roman

7.3.1 Although there is a major Roman *Colonia* at Gloucester and a possible villa at Tidenham, the known Roman archaeology within the RCZA survey area is less dense than that from the prehistoric period, with only 186 sites and monuments of Roman date within the data collected for the RCZA survey area (Figure 16).

7.3.2 Roman pottery has been recovered from the foreshore at Awre; Hills and Oldbury Flats; Clevedon; Sand Point and Donniford beach and there are scatters of pottery and other Roman material along the Portishead Ridge. The pottery from the foreshore has led to the suggestion that land reclamation at Longney, Rodley and Elmore are of Roman date, but this has not been proven by excavation. The Great Wall at Elmore may relate to Roman coastal defence, rather than land reclamation.

7.3.3 Evidence for Roman settlement was excavated during the construction of the Oldbury to Aust pipeline and from work in advance of the construction of the Second Severn Crossing. Possible buildings of Roman date are recorded at Combwich and Burnham on Sea and there are possible farmsteads to the west of Hinkley Point and at Williton. A Roman temple is known from Brean Down and there are numerous coin finds from Weston-super-Mare.

7.3.4 There is surprisingly little Roman material from the coast to the west of the Parrett, including the Exmoor coast.

7.3.5 The major concentrations of Roman material within the RCZA survey area can be summarised as:

- Awre (See 6.3.2 above, SMP PUs 11 and 12)
- the coast between Hills Flats and Aust (See 6.6 above, SMP PU 9)
- the Portishead ridge
- Clevedon (SMP PU 17)
- Weston-super-Mare (SMP PUs 20 and 21)

7.4 Early medieval

7.4.1 Of all the periods considered here, the early medieval period is the most poorly represented with only a total of 62 records from the RCZA survey area (Figure 17). A number of these records relate to church buildings and place names, but a “sub-Roman” cemetery is known from Station Road, Portishead and finds of this date have been made at Bridgemacote. Perhaps the most distinctive archaeological feature of this period is Offa’s Dyke, which ends at Sedbury Cliffs.

7.4.2 As the records for this period are so sparse, there are no identifiable concentrations within the survey area. The coast between Portishead and Brean Down (SMP PUs 17-21) does, however, appear to form a minor concentration of records.

7.5 Medieval

7.5.1 A total of 631 records for the medieval period are present within the data collected for the RCZA survey area (Figure 18).

7.5.2 A large number of the records for this period consist of ridge and furrow either transcribed from aerial photographs or recorded in the field. Other features relating to agriculture and subsistence include deer parks, rabbit warrens and deserted farmsteads. Fish traps of possible medieval date are recorded at East Quantoxhead, Langford grounds off Kingston Seymour; within Bridgwater Bay and in Minehead and Porlock bays, although there is very little archaeological evidence for the date of construction of any of these features. The total number of recorded fish traps has been significantly enhanced by the NMP task of this project (Dickson and Crowther 2007).

7.5.3 Coastal defence and sea walls thought to be of medieval date are recorded at Clevedon, Severn Beach, Awre and Slimbridge, although some coastal defence features which are thought to be of Roman date may in fact belong to the medieval or later periods. Reclamation during this period was driven by the monastic estates of Glastonbury, Bristol and Gloucester and there are priories at Llantony (Secunda) and at Woodspring.

7.5.4 A medieval quay was excavated at Woolaston Pill and another is suspected at Quay Hill Pill, Hill, but there are surprisingly few medieval maritime sites recorded in the SMR/HERs for the RCZA survey area.

7.5.5 Although the medieval records from the HER/SMRs are fairly evenly spaced along the survey area, concentrations are notable at:

- Oldbury on Severn (See 6.6.3 & 11 above, SMP PU 9)
- Clevedon/Kingston Seymour (See 6.8.3 above, SMP PUs 17 & 18)
- Uphill (south of Weston-super-Mare, SMP PU 21)
- Kilve/West Quantoxhead (SMP PU LILS)

7.6 Post-medieval

7.6.1 As might be expected, this period has the highest number of records: a total of 1,798 are present within the data collected for the RCZA survey area (Figure 19).

7.6.2 As the records for this period are so diverse, it is difficult to meaningfully quantify the data. Of particular relevance to the RCZA survey are the fish weirs recorded from the intertidal zone, in particular those in Porlock, Minehead and Bridgwater bays; to the south of Clevedon; at Sand Point and at Oldbury. Again, there is no good archaeological evidence for the date of construction of the vast majority of these features, which probably cover a date range from early medieval to relatively recent (6.10.6 above)

7.6.3 Wrecks are known off Brean Down, at Aust, and have been used to reinforce the bank at Purton, Sharpness and at Lydney.

7.6.4 Features such as docks and harbours are recorded on a large scale at Lydney Docks and a dockyard railway is recorded at Beachley. Smaller docks are recorded at Kilve, Lilstock and Frampton Pill. Features associated with the ferry at Aust have been extensively recorded but other crossings, such as that at Old Passage, Arlingham, have not been recorded in detail.

7.6.5 Many post-medieval sites are located to the north and south of the mouth of the River Avon and concentrations of records for this period can be summarised as:

- the area around Awre (See 6.3.2-5 above, SMP PUs 11 & 12)

- from the Avon to the Severn Crossings in the north (SMP PUs 7& 15)
- from the Avon to Brean Down in the south (including the towns of Portishead, Clevedon and Weston-super-Mare) (SMP PUs 17-21)

7.7 Modern

7.7.1 A total of 1,015 records for the modern period are present within the data collected for the RCZA survey area (Figure 20). A particular problem with this period is that some HER/SMRs record archaeological interventions as "Modern" events, whilst others do not, thereby creating a bias in the records between different HER/SMRs.

7.7.2 The majority of the records for the modern period relate to World War II, and include pillboxes, anti-invasion defences and airfields and an inter-war bombing range on Stert Flats. Some sites from WWI are recorded, although these are rare.

7.7.3 Unsurprisingly, there are many records of this period from the major towns such as Clevedon, Portishead and Weston-super-Mare, and modern docks such as those at Avonmouth and Sharpness are well documented.

7.7.4 Particular concentrations of modern records occur:

- at Arlingham and Rodley (SMP PUs 11-13)
- in the area of the Severn Crossings (SMP PUs 7 & 9)
- at Avonmouth and along the River Avon (SMP PUs 15 & 16)
- Clevedon and Portishead (SMP PU17)
- Weston-super-Mare (SMP PUs 20 & 21)
- between Porlock and Minehead (SMP PU SELW)

7.8 Undated/uncertain

A total of 376 records recorded as of Undated/Uncertain period are present within the data collected for the RCZA survey area, but only Gloucestershire and Somerset supplied data which contained records classified as of uncertain/unknown date (Figure 21). Some of these are broadly dateable to the post-medieval period, but the majority relate to undated earthworks. Significant numbers of records of unknown/uncertain date relate to fish weirs and sea defences.

7.9 Wrecks

The receiver of wrecks lists a total of 196 wrecks from the Bristol Channel/River Severn area (between 51 52'.889 N 002 14'.297 W; 51 12'.046 N 002 14'.085 W; 51 11'.323 N 003 41'.666 W and 51 52'.149 N 003 43'.193 W), although this includes areas outside the survey area considered here. A total of 113 of these wrecks are recorded as being charted and 114 are shown on bathymetric data supplied by SeaZone Solutions. Parker (1999) recorded a total of 42 hulks reinforcing the bank of the river at Purton, although Paul Barnett (pers comm.) suggests that there are at least 81 vessels in this area and a further 13 at Lydney.

7.10 Scheduled Monuments

A total of 32 Scheduled Monuments are located within the RCZA survey area (Figure 22). These include five bronze age burial mounds; two Iron Age hillforts; a Roman Villa; two Norman mottes; a medieval cross, monastery and deserted farm; fish weirs; Lydney Harbour and an anti-aircraft battery.

Table 1: Scheduled Monuments in the RCZA Survey Area

ID No.	NAME	EASTING	NORTHING	SMP PU
13811	MULTI-PERIOD SITE ON BREAN DOWN	328796	159035	21/BURN
22827	BOWL AND DISC BARROWS 600M NNW OF SANDPOINT FARM	332713	166050	19
22828	MOTTE AND BAILEY CASTLE 650M NNW OF SANDPOINT FARM	332639	166039	19
22835	BELL BARROW 650M SOUTH-WEST OF UPHILL FARM	331612	157914	21
22841	WORLEBURY CAMP: LARGE MULTIVALLATE HILLFORT	331323	162499	20
22847	WOODSPRING PRIORY, ASSOC. PONDS AND FIELD SYSTEM	334314	166111	19
22852	SLIGHT UNIVALLATE HILLFORT AT WAIN'S HILL	339104	170667	17
22863	SLIGHT UNIVALLATE HILLFORT, TWO AVENUES, SAUCER BARROW, REGULAR AGGREGATE FIELD SYSTEM AND ASSOCIATED EARTHWORKS ON WALTON COMMON	343071	173951	17
24031	IRON AGE DEFENDED SETTLEMENT, FURZEBURY BRAKE	293588	148299	SELW
28520	SOCKET OF A WAYSIDE CROSS AT THE CROSSROADS NEAR SIX BELLS FARM, WESTBURY ON SEVERN	372197	213808	12
28811	CHURCHYARD CROSS IN ST GILES CHURCHYARD, MAISEMORE	381379	221640	13
28842	OVER BRIDGE	381608	219578	13
28885	HEAVY ANTI-AIRCRAFT BATTERY 520M EAST OF HOLES MOUTH, AVONMOUTH	352422	180828	15
33712	DAW'S CASTLE, WATCHET	306184	143219	WATC
33714	MOTTE WITH TWO BAILEYS IMMEDIATELY EAST OF BRISTOL ROAD, DOWN END	330899	141364	N/A
33715	WAYSIDE CROSS 100M SOUTH EAST OF DONIFORD FARM	308838	142897	WATC
33730	FOUR MEDIEVAL FISH WEIRS EAST OF MINEHEAD HARBOUR	297645	147056	MINE
35328	CAIRN ON BOSSINGTON HILL	290839	148625	SELW
34859	OFFA’S DYKE, SEDBURY	354832	193041	9
35586	CROSS IN THE CHURCHYARD OF ST DECUMAN, WATCHET	306493	142684	WATC
GC102	ROMAN VILLA 600YDS (550M) SW OF WOOLASTON STATION	359721	198682	9
GC337	LLANTHONY SECUNDA PRIORY, GLOUCESTER	382403	217974	14
GC339	OVER EARTHWORK	381367	219779	13
GC435	BROAD STONE, TIDENHAM	357763	197246	9
GC462	HEMPSTED VILLAGE CROSS	381466	216948	13
GC463	LADY'S WELL	381447	217323	13
GC474	LYDNEY HARBOUR	364936	201364	9
NS1	TWO PALMERSTONIAN GUN BATTERIES ON STEEP HOLM	322658	160572	22
NS12	CHURCHYARD CROSS, ST JOHN'S, WESTON-SUPER-MARE	331792	161933	21
SO28	WICK BARROW PIXIE'S MOUND	320908	145575	LILS
SO480	REMAINS OF 14TH CENTURY CHANTRY AT KILVE	314644	144024	LILS
SO503	DESERTED MEDIEVAL FARM, W OF BRAMBLE COMBE	294054	147915	SELW

8 Areas of high archaeological potential

8.1 Areas of greatest significance

8.1.1 The geographical extent of the RCZA survey area and the number of archaeological sites and monuments it contains precluded detailed assessments of significance being carried out to English Heritage MPP standards as part of the project being reported on here. Further work would need to be carried out on all heritage assets not currently designated as such for full assessment of their significance in terms of local, regional and national importance. Detailed assessments of significance would also need to be undertaken as part of Environmental Impact Assessments carried out in advance of infrastructure projects and other developments.

8.1.2 Previous work has identified archaeological deposits of possible national or greater significance (Figure 23) at:

- Woolaston (See 6.2 above, SMP PU9)
- Awre (See 6.3 above, SMP PUs 11&12)
- Longney/Elmore (See 6.5 above, SMP PU13)
- Arlingham (See 6.5 above, SMP PU12)
- Hills Flats/Oldbury (See 6.6 above, SMP PU9)
- Brean Down (See 6.9 above, SMP PUs 21 and BURN)
- Eastern Bridgwater Bay (See 6.10 above, SMP PU PARR)
- Minehead Bay (See 6.11 above, SMP PU MINE)
- Porlock (See 6.11 above, SMP PU PORL)

Important prehistoric and Roman deposits were also located during archaeological work in advance of the Second Severn Crossing in the Avonmouth Levels.

8.2 Areas of low record density

Areas with few SMR/HER records, and therefore of potential for future research, include:

- Tidenham/Sedbury (SMP PU 9)
- Bullo (SMP PU 12)
- Lower and Upper Dumball (Westbury-on-Severn parish)(SMP PU12)
- Frampton Sand/New Grounds (SMP PU 11)
- King Road/Avonmouth (SMP PUs 15 & 16)
- Sand Bay (SMP PU 20)
- Berrow Flats (SMP PU BURN)
- Dunster Beach/Blue Anchor Bay (SMP PU MINE)

8.3 Research themes

Themes which have been identified as requiring more archaeological work include:

- The evolution and absolute dating of sea defences
- The chronology of land reclamation
- The date and function of the Great Wall of Elmore
- The chronology and typology of fishing structures in the intertidal zone
- Waterfront archaeology (including landing stages, quays and ferries)
- The nature of the prehistoric wetland economy and the relative importance of fishing and dairying
- Aerial reconnaissance in areas where ridge and furrow is being ploughed-down and revealing underlying archaeological sites and monuments
- Watercraft and wrecks
- Trade
- Submerged landscapes

9 Threats to the archaeological resource

9.1 Threats to the archaeological resource identified in the RCZA survey area can be characterised in two ways:

- "natural" threats such as coastal change and rising sea-levels

- anthropogenic threats such as coastal defence schemes; infrastructure works (tidal barrage, road schemes); compensatory measures for habitat loss as a result of natural or anthropogenic change and increased visitor pressure due to improved coastal access.

9.2 Natural threats to the coastline of the Severn Estuary were assessed as part of the national FutureCoast survey undertaken by DEFRA and the results are presented in section 13 of this report. In order to understand how the coast has changed in the past, the following synthesis was undertaken (by Richard Brunning of Somerset County Council) of all the previously published studies of sea-level change in the estuary. This was coupled with an analysis of historic Ordnance Survey mapping which were subsequently mapped into the project GIS. A further aspect of the analysis of coastal change was to map the locations of boreholes undertaken for geological and archaeological research as a way of assessing which parts of the coast have been well studied and those which may require further work.

9.3 The Tidal Severn Flood Risk Management Strategy and the CHAMP and SMPs for the Severn Estuary outline the anthropogenic responses to these threats, and this information is summarised in section 14. Other anthropogenic threats include the possible construction of a Severn barrage, which is most likely to be located between Brean Down and Lavernock Point. As the location and form of a barrage (not to mention economic and environmental factors) is currently being considered alongside other tidal power options, it is not possible to assess the potential threat to the archaeological resource through this study. Other infrastructure works, such as proposed expansion of port facilities at Avonmouth, the renewal of the "old" Severn Crossing, the construction of new roads and other coastal development work, are mitigated by the planning process and potential areas of threat will not be identified here.

10 Coastal change on the English side of the Severn Estuary from the Palaeolithic to the present day by Richard Brunning

10.1 Introduction

This report was produced by Dr. Richard Brunning, Somerset Levels and Moors Archaeologist for Somerset County Council. It has benefited from comments by Vanessa Straker, English Heritage Regional Science Advisor.

In order to understand the archaeological record of the present day coast a thorough understanding of past coastal change is essential. Some previous syntheses of coastal change and the influence of sea level fluctuations have been published, most notably by Kidson and Heyworth (1976), Allen (2001a and 2006) and Haslett *et al.* (2001a). A large number of palaeoenvironmental investigations have taken place in recent years, especially through the development control system. These have added considerably to our knowledge of costal change. In addition there is an increasing understanding of past climatic fluctuations in Europe (eg. Magny 2004).

10.2 Pre-Anglian and lower and middle Paleolithic sea level changes (Oxygen Isotope Stages 17-6)

10.2.1 The Pleistocene landscape of the Severn Estuary area is now largely submerged and covered by deep deposits of clay, silt or peat. The solid rock base of this landscape was shaped by river action and fluctuating sea levels during the Pleistocene. The morphology of the Pleistocene Severn valley has been well mapped by a combination of hydrographic, geophysical and borehole evidence from Gloucester to the central Bristol Channel (Andersen 1968 and BGS 1983, 1986).

10.2.2 The main Severn valley is known to have a network of subsidiary valleys feeding into it from the English and Welsh side of the present estuary, all now drowned under present day valley systems. These have been studied in most detail on the Welsh side of the estuary but some work has been carried out in North Somerset Bristol (Leese and Vernon 1960, Hawkins 1962, 1990, Gilbertson and Hawkins 1978 and Evans and Thompson 1979). The area with the least information is the Somerset Levels area where few studies of the submerged Pleistocene landscape have been carried out, with the exception of limited published work by Kidson and Heyworth (1976) and the crude evidence of a series of boreholes taken in advance of construction of the M5. Modern revision of the Glastonbury sheet by the British Geological Survey, that covers the southern part of the project area, is only now beginning. The work required to bring the sheet up to the modern standard should produce a much greater understanding of the tributary valleys.

10.2.3 Allen's summary map of the estuary during the later Quaternary (Allen 2001a fig.2) has a series of question marks along the Somerset and North Somerset coastline reflecting a continuing lack of information for this area. Inland of the question marks the line of the former valleys is also largely hypothetical due to a lack of published data. Heyworth and Kidson published a contour map of the pre-Holocene land surface in the Somerset Levels (1976 fig.9), based largely on unpublished data. This is now known to be a significant over-simplification of the submerged landscape which means that it is hard to know how far it can be trusted.

10.2.4 Sea levels and therefore coastlines were constantly changing during pre-Anglian periods and the Lower and Middle Palaeolithic (*c.*787-135ka BP) as the climate fluctuated between warm and cold stages, glacial and interglacial periods. It is not possible to map the

infinite variety of coastline forms that occurred in the study area during this time and precise local data about sea level is very sparse, largely because it has been destroyed by later erosion events. The shape of the estuary would have had a considerable effect on the tidal range within the survey area. This means that it is not possible to directly apply sea level information derived from elsewhere to create a coastal model for the survey area.

10.2.5 During the earlier Pleistocene glaciations, sea levels were lowered by up to 120m. At these times there was considerable downcutting of the Tertiary geology by the River Severn and its tributaries. The Hoxnian (OIS 11) and Purfleet (OIS 9) interglacial periods were as warm as the later Ipswichian warm stage and sea levels could be expected to have reached similar heights. The four Cromerian (OIS 19, 17, 15, 13) and Aveley interglacials were almost as warm and would probably have produced mean sea levels only slightly less high (OIS 7). The evidence from the survey area for the Ipswichian interglacial, discussed in the next section, demonstrates that even where there is local evidence the exact form of the coastline is hard to determine.

10.2.6 Greylake sand quarry 2 in Somerset contains beds of the Greylake Member (Campbell *et al.* 1999) that are thought to date to OIS 7 and beds 7-9 at Woodside, near Weston in Gordano, may also be of similar date or even of OIS 9 (Hunt 2006). The latter beds reach to 13.6m OD and are thought to represent intertidal flats, suggesting mean Sea Levels not lower than 14m OD (ApSimon and Donovan 1956).

10.3 Ipswichian warm stage (*c.*135-110ka BP) OIS 5e

10.3.1 During this warm stage the global sea level rose rapidly with evidence from coral reefs and the Greenland ice cap implying a highstand of *c.*6m OD (Cuffey and Marshall 2000 and Allen 2001a) although local evidence suggests a higher possibility (see below). There is evidence of rock platforms and raised beaches formed at this time at Weston-super-Mare, Woodspring and Weston in Gordano (Gilbertson and Hawkins 1977, Whittaker and Green 1983, Bowen *et al.* 1985, Briggs *et al.* 1991 and Hunt 2006).

10.3.2 The Burtle sand beds of the Somerset Levels are extensive formations created as estuarine shoals and sand flats (Bulleid and Jackson 1937, 1941, Kidson 1970, Andrews *et al.* 1979, Hunt and Clark 1983 and Hunt 2006). The known outcrops represent the uppermost deposits of the formation resting on rock outcrops. More extensive deposits of the same formation are likely to exist at much lower altitude on top of the rock head in the drowned valleys (eg. Heyworth and Kidson 1976 and Hill *et al.* 2006).

10.3.3 Greylake sand quarry 2 in Somerset contains beds of the Middlezoy Member (Campbell *et al.* 1999) that have been equated to OIS 5e. The mollusc, foraminifera and ostracod evidence form these levels suggest deposition around Low Water Neap Tides. This has been used to suggest a Mean Sea Level of 12m above modern MSL and a high tide level of around 18m OD (Kidson *et al.* 1987 and Hunt 2006)

10.3.4 Current thinking suggests that human occupation of Britain ceased during oxygen isotope stage 6, the Ipswichian interglacial (OIS5e) and the early stages of the Devensian glaciation (up to OIS4) from *c.*135ka BP to 60ka BP (Knight and Howard 2004, 17). During this time there would have been no land bridge to the continent.

10.4 Devensian glaciation (*c.*110-10.5ka BP)

10.4.1 During this cold stage sea levels dropped considerably as water was taken up in ice cap formation. This probably reached the greatest extent *c.*19-23ka BP when sea level would have been tens of metres below the present day.

10.4.2 During the Devensian glaciation there were interstadial periods when sea level was much higher. Within the survey area the Low Ham Member of the Parrett Formation (Campbell *et al.* 1999) is a complex of sands, silts and peats east of High Ham island that are consistent with a back estuarine environment. Amino-acid ratios suggest a date of late OIS 5 or early OIS 3 and definitely postdate the Ipswichian Burtle Formation (Hunt and Bowen 2006). Indicators of marine influence were recorded at 13.8m OD which, allowing for tidal funnelling suggest a mean sea level of *c.*2-5m OD (Ibid, 189).

10.4.3 The Gordano valley contains peat deposits at 1.51m OD that have been dated to 15,060-14,840 or 14,260-14,220 or 14,130-13,820 Cal BP (Beta-189680) suggesting formation during the Bølling sub-interstadial (Hill *et al.* 2006) when temperatures in northwest England reached 13.4ºC (Bedford *et al.* 2004). This suggests that sea level must have been similar to or lower than present levels at that time.

10.5 The Holocene (*c.*10.5ka BP – present)

10.5.1 There is a wealth of information concerning coastal change in the Holocene from both sides of the Severn Estuary with many detailed and well dated palaeoenvironmental sequences. This evidence has revealed an extremely complicated picture of coastal change, underpinned by fluctuations in sea level rise (and fall) but also influenced by a host of other factors such as climate change (and tracks of depressions) and the formation and destruction of natural coastal barriers. Allen (2006, 17) acknowledged that such factors and agencies, particularly local factors over-riding wider trends, combined 'to create a seemingly haphazard range of lithostratigraphic responses as expressed in the estuarine/coastal Holocene of southern Britain'.

10.5.2 The same paper used palaeoenvironmental evidence and 138 associated radiocarbon dates from the Severn Estuary to demonstrate that the Holocene sequence in the area had a broad tripartite lithostratigraphic division that corresponded to similar evidence from southern Britain and elsewhere in north-western Europe. The division distinguished early Holocene silt dominated sequences, formed in mudflats and salt marshes, from mid Holocene intercalated silts and peats (formed in high-intertidal to supratidal marshes) and then a return to silt dominance in the late Holocene (Allen 2006). In the survey area this division has been formalised into the Lower, Middle and Upper Somerset Levels Formation (Haslett *et al.* 2001b) corresponding to the Wentlooge Formation on the Welsh coast.

10.5.3 The evidence summarised below demonstrates that the variations within this broad tripartite division could be considerable and heavily influenced by local topographic factors. The availability of numerous scientific dates for coastal changes on the English side of the estuary demonstrates the continuous nature of such changes and the short timescale over which many of them took place. The tripartite division is also brought into question by the existence of intercalated peat deposits in the earlier Holocene sequence (eg. Heyworth and Kidson 1976, Hill *et al.* 2006 and Wilkinson 2007). The early Holocene is less often studied because it is more deeply buried behind the present coast. The peat layers from this epoch have also suffered more compaction than later similar deposits because of the substantially greater overburden.

10.5.4 The rate of relative sea level rise is constantly being recalculated at a national level (eg. Shennan *et al.* 2000) but more importantly has been revised within the Severn Estuary area in recent years (eg. Allen 1990b, Long *et al.* 2001 and Haslett *et al.* 2001a).

Phase	cal. BC	MSL rise (m)	Av. rate (mm yr^{-1})
1	7,500-5,500	-25 to -10	7.5
2	5,500-4,000	-10 to -5	3.3
3	4,000-0	-5 to -2.5	0.6

Table 2: Rates of relative sea level rise in Bridgwater Bay (after Long et al. 2001)

10.6 Early Holocene *c.*8,500-5,000 Cal BC

10.6.1 Climatic amelioration at the end of the Devensian glaciation appears to have occurred rapidly with temperatures broadly comparable to those of today being reached within a few hundred years between *c.*7,850 and *c.*7,550 BC (Figure 24, Atkinson *et al.* 1987 and Coope and Lemdahl 1995). The retreat of the glaciers led to eustatic global sea level rise from around –55m OD at the beginning of the Holocene to present day levels by *c.*4,900 Cal BC (Tooley and Shennan 1987). This led to the submergence of the present Severn Estuary, the Somerset Levels and Moors, and the North Somerset and Avon Levels by *c.*4,500 BC.

10.6.2 Thin peat layers are known from deep cores along the Somerset coastline and the M5 route (Kidson and Heyworth 1976 and Long *et al.* 2001). These represent possible fluctuations in sea level rise giving rise to the formation of upper saltmarsh or supratidal marsh conditions. They exist between –21.3mOD up to *c.*-2m OD just below the beginning of the peat dominated Middle Somerset Levels Formation. It may be possible to separate them out into a group between –20m OD and –12m OD and an upper group between –8mOD and –2mOD (Long *et al.* 2001) but such a division seems unproductive because of the lack of dating information for most of the layers. Their existence suggests that the difference between the Lower and Middle Somerset Formations are not as strong as has previously been suggested.

10.6.3 Scientific dates for the Lower Somerset Levels (Severn) Formation, dated to before *c.* 5,000 Cal BC, have been very limited but have been increased by recent work at Minehead (Jones *et al.* 2005) Woolaston (Brown *et al.* 2006) Burnham-on-Sea (Druce 1998) and Porlock (Jennings *et al.* 1998). They are presented in Table 3. The dates available before 1998 were used as sea level index points to suggest Mean Sea Levels although palaeoenvironmental analysis had not been carried out on most of the earliest samples. This suggested that the Highbridge cores represent a MSL of –25 to-26mOD at *c.*7,500 Cal BC (Jennings *et al.* 1998). By *c.*5,900 to 6,200 Cal BC MSL had risen rapidly to between *c.*-12.5 to –14m OD and by *c.*5,000 Cal BC MSL was *c.*-8mOD (Jennings *et al.* 1998, table 1, 166).

10.6.4 The implications of this rapid sea level rise on the changing coastline have been modelled in detail for the central Axe valley (Haslett *et al.* 2001b) where the marine sediments of the Lower Somerset Levels Formation were studied in detail. Between *c.*8,000 and 5,000 Cal BC the sea level rise was *c.*5-6mm yr^{-1} (Haslett *et al.* 2001a, or 7.5 according to Long *et al.* 2001). During this time the estuarine surface, which penetrated far inland of the modern coastline, would have been dominated by mudflats/low marsh environments. Mid to high marsh would only occupy a narrow, relatively steeply inclined, fringe along the coastline

(Haslett *et al.* 2001a). There would be a need to transfer a large amount of tidal water off the surface of the low marsh during flood and ebb tides. This high hydraulic duty (Allen 1997d and 2001a) would require a relatively dense network of wide and deep tidal creeks.

10.7 Transition from lower to middle Somerset Formation *c.*5,000-1,500 Cal BC

10.7.1 From *c.* 5,000 Cal BC (Figure 25) the rate of sea level rise began to decrease from the previous very rapid rate of *c.*5-6mm y yr^{-1} to *c.*2mm yr^{-1} between *c.*5,000 and 3,000 Cal BC (Haslett *et al.* 2001a). This had major effects on the development of the coastline as organic sedimentation began to outpace sea level rise. This allowed the development of the Middle Somerset Levels Formation and Middle Wentlooge peat dominated environments over the survey area. It seems unlikely that an increased sediment load in rivers due to deforestation played a role in this change, as extensive permanent clearance over most of the catchment did not occur until the late Bronze Age, continuing through the 1st-millennium BC (Wilkinson and Straker 2008, Straker et. al. 2008)

10.7.2 The deceleration in sea level rise would have allowed the mid marsh environments to expand and dominate a larger part of the estuary with a decrease in hydraulic duty and a corresponding decrease in tidal creek size. Eventually the higher marsh environments would squeeze out the middle marsh and would dominate the estuarine environment with small tidal creeks and a reduction in tidal flooding frequency (Haslett *et al.* 2001a).

10.7.3 The timing of the change from silt to peat environments and the character of the peat environments varied from place to place along the estuary (see table 3 for the different radiocarbon dates). In general the peat deposits are thicker inland while towards the coast they become increasingly intercalated with silt layers at Minehead, Stolford, Burnham-on-Sea, Huntspill and East Brent. The available evidence can be summarised form SW to NE along the survey area as follows;

10.7.4 Porlock Bay: The main peat layer at Porlock formed between *c.*4,500 Cal BC and *c.*3,540 Cal BC after which it was overlain by deposits of sand, grit, silt and clay (Jennings *et al.* 1998). The cessation of the organic formation in this area partly reflects the increased vulnerability of the coastal gravel barrier to storm events as the deceleration of sea level rise decreased longshore sediment supply. In addition anthropogenic disturbances within the catchment may have increased the supply of inorganic material into the area (Jennings *et al.* 1998).

10.7.5 Minehead Bay: Three periods of peat deposition were identified on the present foreshore at Minehead (Jones *et al.* 2005). The earliest deposits were created in marginal saltmarsh conditions around 5,000 Cal BC and an alder carr peat sometime between 5,400 and 5,000 Cal BC. There was then another gap of several hundred years until peats laid down in a mixture of upper saltmarsh, freshwater reedswamp and alder carr environments were created sometime between *c.*4,800-4,500 Cal BC.

10.7.6 Parrett Valley: Very little dating and analysis has been carried out in this area. Around the mouth of the Parrett between Stolford and the Poldens, Heyworth and Kidson (1982) recorded the Middle Somerset Levels Formation as intercalated peat and clay along the coast and as a thick peat layer further inland, deposition beginning around 4,000 Cal BC. The Middle Somerset Levels Formation exists as a thick peat layer in the central Parrett valley and has been briefly characterised by Alderton (1983) and has been dated on its base at Sutton Hams to *c.*3,900 Cal BC (Coles and Dobson 1989). Further inland near Langport recent evidence has dated the base of the Formation to 4840-4520 Cal BC (Wilkinson 2006 see table 3 for details). This limited evidence suggests that the organic deposits of the

Formation developed seawards over a period of several hundred years in the 5th millennium BC.

10.7.7 Brue/Axe Valley: Intercalated peat and silt deposits are known from Burnham-on-Sea (Druce 1999), the Huntspill River (Brunning and Farr Cox 2006), Walpole (Hollinrake and Hollinrake 2002) and East Brent (Haslett *et al.* 2001a). The M5 boreholes also show similar deposits (Long *et al.* 2001) although the accuracy of the interpretation may be open to question and they are undated. The intercalated peat deposits have been dated between 5,440 and 3,370 Cal BC at Burnham-on-Sea (Druce 1999) and between *c.* 4,780 and 1,320 Cal BC at Walpole (Hollinrake and Hollinrake 2002). Godwin (1960) recorded intercalated peat and silt on the River Huntspill between Puriton Bridge and Withy Bridge. At Withy Bridge two peat layers (not noted by Godwin) formed in higher saltmarsh conditions in the later Bronze Age (1523 to 1311 cal. BC) and early Iron Age (895 to 674 cal. BC; Vickery 1999). The transect between Brean and Wedmore (Haslett *et al.* 2001a) showed the main peat deposit dividing into intercalated peat and clays at Brean and to the south in the area north of Brent Knoll. The beginning of the peat formation is dated to 4,200-3,200 Cal BC and its surviving end to between *c.*2,000 and 1,500 Cal BC (Haslett *et al.* 2001a).

10.7.8 In the Axe valley the beginning of the main peat layer has been dated to between 4,905 and 4,540 Cal BC, continuing until sometime between 1,775 and 1,425 Cal BC (Haslett *et al.* 2001b). In the central Brue valley peat formation began between 4,500 and 4,000 Cal BC (Coles and Dobson 1989) with an earlier thin peat in places forming possibly as early as *c.*4,700 Cal BC (Wilkinson 1999). This sequence carried on forming into the later prehistoric period and beyond (see below).

10.7.9 N. Somerset and Avon Levels: The Gordano valley provides an unusual example of a long peat sequence, protected from the coast by a sand 'barrier', that begins at 13,110-11,870 Cal BC and resumes after a short hiatus of clayey-silt around 7,630-7,570 Cal BC (Hill *et al.* 2006). Peat kept forming until at least 4,580-4,440 Cal BC after which another 1.47m of peat formed (Ibid). On the other side of the barrier three peat bands formed between 5,370-5,270 Cal BC and 1,890-1,650 Cal BC, intercalated with sand and silt deposits. This resembles the coastal pattern of intercalated deposits further south in Somerset (see above). A similar situation occurs on the Berkeley Level (eg. Lucy 1877, Allen 2001a).

10.7.10 Inner Severn Estuary: The equivalent of the Middle Wentlooge/Somerset Levels Formation exists in the Lydney, Elmore, Rodley, Arlingham, Awre and Slimbridge Levels as a thick, mainly woody peat (Lucy 1877, Prevost *et al.* 1901, Hewlett and Birnie 1996 and Allen 2001a, 22). The date of the initiation of peat growth is not known at these locations.

10.8 Transgressions and regressions of later prehistory *c.*1,500 Cal BC- 0 Cal BC

10.8.1 In the second millennium BC there is a significant shift from the Middle to the Upper Somerset Levels Formation and their equivalents over most of the survey area. This represents a shift from upper saltmarsh and supratidal environments to lower to mid marsh environments. In the North Somerset Levels recent studies showed evidence of positive sea level tendency until the proposed Roman reclamation (Haslett *et al.* 2000) and analysis of sediments in the Axe valley showed a positive sea level tendency throughout all the Upper Somerset Levels Formation (Haslett *et al.* 1998a). This suggests that throughout the later prehistoric period sea level continued to rise at a significant rate and faster than the sea level curves suggest (Haslett *et al.* 2001a, 48).

10.8.2 At several locations along the coast, peat formation ceases at similar dates in the second millennium BC. At Walpole, in Somerset the last peat was formed sometime between 1,603 and 1,320 Cal BC after which silts and clays dominated (Hollinrake and Hollinrake 2002). Further north at the lower end of the Axe valley silt deposition dominates from sometime around 2,000-1600 Cal BC (Haslett *et al.* 2001a). Further up the Axe valley near Nyland the change from peat to silt occurs sometime between 1,775 and 1,510 cal. BC (Haslett, *et al.* 1998a).

10.8.3 Clay of the Upper Somerset Levels Formation also extends from the head of the Axe valley through the Panborough Gap into the Brue valley around Godney Moor and southwards through the Godney Gap into East Backwear (Godwin 1955, Housley *et al.* 2000). The transgressive change has been dated to between 1120 and 950 Cal BC at Long Run farm south of Godney. This represents the furthest extent of the transgression in Somerset and appears to have occurred at least several hundred years after the change in the Axe valley and at Walpole.

10.8.4 Rising sea level increased base levels further inland and led to flooding of the raised bog in the central Brue valley with calcareous water and the establishment of sedge fen (Godwin 1960) associated with the Meare Heath (Bulleid 1933, Godwin 1960, Coles and Orme 1976, Coles and Orme 1978a, *Coles et al.* 1988) and Tinney's Tracks (Coles and Orme 1978b, Beckett 1978, Girling 1978, Coles and Orme 1980). These two trackways have dated tree-ring chronologies, tying down their construction to sometime between 1550 and 1450BC (Tyers 2004). As they appear to have been built in response to the increasing wetness on the bog surface they provide probably the most precise date for the transgression and associated rise in base levels.

10.8.5 In the Parrett valley near Langport the transition form the Middle Somerset Formation peat to a silt-depositing environment has been dated to 1130-840 Cal BC (Wilkinson 2006). This corresponds well to the dates for a similar change south of Godney (above) suggesting that the transgression lasted for several hundred years and penetrated inland gradually.

10.8.6 In the North Somerset and Avon Levels change seems to have occurred at a similar date. In the Gordano valley outside the sand 'barrier' peat formation ceased around 1,890-1,650 Cal BC to be replaced by silty clay (Hill *et al.* 2006).

10.8.7 Further up the estuary at Avonmouth the peat deposits continued to form until a later date of between about 1210 to 920 cal. BC (Moore *et al.* 2003). This is almost exactly the same date as that obtained for the changes from peat to estuarine clay south of Godney Island in the upper Brue valley (Housley *et al.* 2000). The English side of the Severn Estuary appears to have been subject to a creeping transgression between *c.*1,600 and 900 cal. BC.

10.8.8 In the inner Severn Estuary peat growth ceases on all the small Levels. The top of the peat deposits have been dated to between 800 and 200 Cal BC at Elmore and Longney and 1500-1200 Cal BC at Slimbridge (Allen 2002, Hewlett and Birnie 1996).

10.8.9 It is difficult to identify the exact position of the coastline during this period (Figure 26) because of the absence of peat forming upper saltmarsh/brackish environments. This may be because such deposits were largely eroded by the coastal transgression and/or because they were of very limited spatial extent. The inland extent of the upper saltmarsh is limited by the presence of the main central Somerset Levels peat formation that still dominated the central Brue and Parrett valleys during these periods, although the boundaries of saltmarsh fringing the River Parrett are uncertain. In the Brue valley the raised bog was forming at least as far seawards as Woolavington Bridge on the River Huntspill, representing the unbroken continuation of peat formation since the early Neolithic (Jones 2003, Smith 2003 and Tinsley 2003).

10.8.10 Further up the estuary the possible inland extent of coastal influence is limited by the natural topography restricting the area of the potential floodplain as is also the case at Porlock and Minehead. In the inner Severn Estuary peat deposits were still growing until sometime between 800 and 200 cal. BC (Hewlett and Birnie 1996). These demonstrate that upper saltmarsh and supratidal environments continued to dominate that area until the late Iron Age.

10.8.11 Fluctuations in sea level rise and coastal change in the later Bronze Age and early Iron Age are evident at a limited number of places in the survey area. At Withy Bridge on the Huntspill River in Somerset inter-digitated peat and clay deposits have been dated to the late Bronze Age and early Iron Age (Vickery 1999). On the Avon Levels there have been numerous records of localised patches of soil formation, sometimes associated with human activity. These demonstrate that in localised areas the saltmarsh environments were replaced by terrestrial soils for short periods between *c.*1500 and 800 BC at Cabot Park, Rockingham Farm and Katherine Farm, Avonmouth (Locock *et al.* 1999, Moore *et al.* 2003 and Allen *et al.* 2003).

10.8.12 By the middle of the first millennium BC there is evidence of regressive tendencies in some places, most notably on Godney Moor and the area south of Godney in the Brue valley where freshwater environments began forming peat on top of the estuarine clays between *c.*840-450 cal. BC (Housley *et al.* 2000). Elsewhere on the English side of the Severn Estuary there is a general lack of dated deposits informing coastal change between 800 and 0 Cal BC, reflecting the absence of peat forming deposits over most of the survey area, except for the central Brue and Parrett valleys.

10.8.13 In the last few centuries of the first millennium BC the evidence from Goldcliff, on the Welsh side of the estuary, suggest that transgressive influences were still dominant (Bell *et al.* 2000). Rising sea level may have helped to cause the rising base levels that may have been responsible for the clay filled channel that cut the raised bog at Skinner's Wood in the Brue valley (Horner 1996) and the freshwater conditions in which the nearby Shapwick canoe was deposited (Godwin 1967). Late Iron Age salterns are also known from the Axe valley and the area immediately west of Wedmore (Leech 1997). There is however, no known direct evidence for transgressive events on the English side of the estuary in the Late Iron Age but analysis of forams and diatoms from clays in the Axe valley and North Somerset Levels suggests that the positive sea-level tendency continued throughout the Late Bronze Age and Iron Age (Haslett *et al.* 1998a and 2000) as noted at the beginning of this section. Around the end of the 1st millennium BC the raised bog at Woolavington Bridge on the River Huntspill stops growing and begins to be eroded by saltmarsh creeks (Brunning and Farr-Cox 2006).

10.9 Roman coastlines

10.9.1 Extensive reclamation of much of the coastal wetlands in the survey area appears to have taken place during the Romano-British period (Figure 27). In a few places the coast was seaward of the present coastline, while in others extensive saltmarshes still penetrated far inland. In general it is evidence of reclaimed freshwater landscapes that is most indicative of the coastline for this period rather than direct evidence for the coastal environments themselves.

10.9.2 There is a general lack of information regarding the position of the coastline in the section of the survey area west of the Polden Hills in Somerset. To the north of the Poldens settlement is known along the finger of hard geology from Pawlett to Highbridge, around Brent Knoll and the area northwards to Brean Down and the Axe and within the Axe valley itself (Rippon 1997a and Grove 2003). This settlement seems to have taken place from the

1st or 2nd centuries AD but environmental analysis of deposits of this period are very rare in the area. Most of the evidence takes the form of artefact scatters or poorly recorded excavations. In the Axe valley extensive remains of a reclaimed landscape are visible as slight earthworks, representing fields, settlements, drove ways and a possible canal (Grove 2003). Reclamation in the Axe valley has been dated chemostratigraphically to 130-221 AD (Haslett *et al.* 1988a). This date is supported by the limited artefactual evidence from the settlements in the area. Recent work to the south of Brean Down shows a marginal saltmarsh/terrestrial environmental environment in the present inter-tidal area that was cut by a ditch indicating freshwater grassland environment seasonally subject to coastal flooding (Allen and Ritchie 2000).

10.9.3 In the North Somerset Levels there is also a mixture of landscapes suggested by archaeological data. It had been proposed that natural sand dune defences protected the coast between Brean Down and Middlehope (Rippon 1997a). The recent (unpublished) discovery of a major Romano-British saltern site at Weston-super-Mare suggests that saltmarsh environments may have penetrated further inland than the present coast at this time. On Banwell Moor and Kenn Moor there is extensive evidence for Romano-British rural settlement in the form of artefact scatters, relic field systems and excavated settlements (Rippon 1997a, 81-87). The latter include the Wemberham villa on the Congresbury Yeo (Reade 1885, 64-73), where occupation is dated to the 3rd to 4th centuries AD. That date range is also replicated in the relic landscape features on Kenn Moor at Yatton where excavation showed occupation in a freshwater environment with a well preserved corn drier complex suggesting arable farming on the wetland (Rippon 1995b, 1996 and 1997a, 82-7).

10.9.4 On the Avon Levels Romano-British occupation was identified at Northwick, Ellinghurst Farm, Rookery Farm and Crooks Marsh Farm (Barnes *et al*. 1993, 7-11 and Lawler *et al*. 1992) suggesting that these areas were also subject to reclamation at this time. These settlements varied significantly in date from the 1st to 2nd centuries AD at Northwick and Rookery Farm, 1st to late 3rd centuries AD at Ellinghurst Farm, and 4th century date at Crooks Marsh (Barnes *et al*. 1993, 7-11, Rippon 1997a, 91-2, Everton and Everton 1980 and Lawler *et al*.1992).

10.9.5 In the inner estuary 2nd to 4th century AD occupation is indicated between Severn House Farm and Oldbury Pill (Allen and Fulford 1987, 249-253). This includes Romano-British artefact scatters over *c.*3km of foreshore, suggesting the coastline of that period was seawards of the present one. At Oldbury excavations inside the sea wall demonstrated the presence of a settlement from the 2nd to the 4th centuries AD (Hume 1992). This limited evidence suggests that the Oldbury and Berkeley Levels were reclaimed during the Romano-British period. Suggested reclamation evidence has been found as far north as Elmore, just 7km south of Gloucester (Allen and Fulford 1990, 17-32). Allen and Fulford (1990, 315) suggested that 80% of the floodplain was reclaimed in the Roman period and 16% on the west with a big expansion in the 3rd century AD (Allen and Fulford 1990, 307).

10.10 Late Roman transgression

10.10.1 There is widespread evidence for a transgressive phase in the survey area beginning in the Late Roman period (Figure 27). The most southerly evidence comes from the Huntspill Cut where a saltern site of 3rd to 4th century AD date was covered by silt deposited in an intertidal environment. The base of the silt has been dated by Optically Stimulated Luminescence to 110 AD ± 290 (Oxl-1268: Rhodes 2003).

10.10.2 In the Axe valley the date of the end of the reclamation and the return of marine influence is hard to determine. The only available estimate is a date between 207 AD and 411 AD (Haslett *et al*. 2001b). The villa at Lakehouse Farm continued in use into the 4th

century AD (Rippon 1997a, 74) suggesting a similar date of transgression to that evidenced from the salterns south of Brent Knoll. The evidence from the North Somerset Levels, Avon Levels, Oldbury and Berkeley Levels and the inner estuary indicates extensive settlement along the coast until the mid 4th century AD (Rippon 1997a, 84-97).

10.11 Early medieval reclamation

10.11.1 The gradual reclamation of the English side of the Severn Estuary coastline in the early medieval period has mainly been studied through landscape characterisation and place name analysis (eg. Rippon 1997a and 2001b) with few detailed excavations (eg. Rippon 1997b, 1998, 1999, 2000 and 2007). Saxon habitative place names suggest occupation along the Severn Levels was very extensive by the late Saxon period although the back fen areas were only colonised much later. By Domesday this zone was definitely reclaimed and farmed intensively.

10.11.2 The irregular field patterns noted along the coastal clay levels suggest that this reclamation took place in a gradual piecemeal fashion. This is supported by the most detailed local study of this process at Puxton (Rippon 2007). The date of reclamation of the coastal marsh is therefore not likely to be consistent across the survey area although Saxon charters suggest that it could have started by the end of the 7th century AD (Sawyer 1968 and Edwards 1998) and was largely complete by Domesday.

10.11.3 The present coastline of Somerset and North Somerset is protected by a chain of barrier beaches of sand and gravel topped by aeolian dune systems. Such barriers were present from at least the Bronze Age (Bell 1990). Very little is known about the shifting extent and location of such barriers, except at Porlock and Brean. By the medieval period the system seems to have been largely in place and aeolian dunes buried part of a medieval settlement at Berrow (Somerset HER 10104).

10.11.4 In the area south of Brent Knoll in Somerset an extensive area of marshland is shown as Brent Marsh on 17th and mid 18th century maps of the county. This area contains evidence of ridge and furrow agriculture. This suggests that the area was reclaimed in the medieval or immediate post-medieval period and then subsequently became marshland again (Brunning and Farr-Cox 2006). Such shifts in the coastline are only likely to be identified by detailed landscape characterisation and investigative fieldwork including palaeoenvironmental analysis and scientific dating

.

Table 3. Scientific dates relevant to coastal change on the English shore of the Severn Estuary

Interpretation	Age cal. BC	RC years BP	Lab. code	Site and Reference
Base lower woody peat	5775-5635	6819+/-33	OxA-13699	**Woolaston**. Brown *et al.* 2006
Thin reed peat above lower peat	4335-4245	5420+/-40	OxA-14003	
Base upper woody peat	4320-3970	5256+/-35	OxA-13878	
Top upper woody peat	3770-3640	4910+/-40	OxA-13879	
Oak tree growth upper peat	4096-3699 tree-ring chronology			
Base reedswamp/saltmarsh peat 1	5670-5380	6600+/-70	Wk- 5311	**Minehead Sites 75-77**. Jones *et al.* 2005
Base reedswamp/saltmarsh peat 2	5640-5370	6570+/-70	Wk- 5310	
Top reedswamp/saltmarsh peat 2	5620-5310	6490+/-80	Wk-5309	
Base brackish/freshwater reed peat 3	5540-5290	6440+/-70	Wk- 5308	
Base alder carr/reed peat	5630-5380	6560+/-60	Wk- 5302	**Minehead Site 27**. Jones *et al.* 2005
Base alder carr/reedswamp peat	4830-4490	5810+/-70	Wk- 5304	**Minehead Site 44-5**. Jones *et al.* 2005
Top alder carr/reedswamp peat	4830-4520	5820+/-60	Wk- 5303	
Base alder carr peat site 45	4780-4460	5770+/-70	Wk- 5305	
Base reedswamp site 46	4710-4360	5700+/-70	Wk- 5306	**Minehead Sites 46-7**. Jones *et al.* 2005
Base reedswamp site 47	4830-4520	5820+/-60	Wk- 5303	
Base of peat (eroded top)	4720-4250	5620+/-100	HAR-8546	**Brean Down** Bell 1990
Forest bed	6609-6425	7730+/-50	Beta-81655	**Porlock Bay**. Jennings *et al.* 1998
Peat	6380-5970	7280+/-90	OxA-6570	
Top second peat	5941-5540	6870+/-90	Beta-61544	
Top second peat	5987-5777	6707+/-50	Beta-86775	
Base fourth peat	4340-3970	5290+/-75	OxA-6572	
Base fourth peat	4460-4040	5450+/-70	OxA-6569	
Base fourth peat	4500-4240	5515+/-65	OxA-6571	
Base fourth peat	4458-3662	5250+/-180	Beta-61542	
Top fourth peat	3940-3540	4925+/-60	OxA-6402	
Top fourth peat	4040-3780	5120+/-55	OxA-6399	
Top fourth peat	4240-3700	5160+/-100	OxA-6401	
Top fourth peat	4225-3705	5140+/-100	Beta-61543	

Interpretation	Age cal. BC	RC years BP	Lab. code	Site and Reference
Base of Middle Somerset Levels Formation peat	3625-3195	4640+/-60	Beta-142351	**Brean-Wedmore Transect**. Haslett *et al.* 2001a
	4335-4050	5370+/-50	Beta-142353	
	4235-3800	5210+/-80	Beta-112355	
	4235-3800	5210+/-80	Beta-142355	
Transition from Middle to Upper Somerset Levels Formation	2010-1650	3500+/-70	Beta-142354	**Brean-Wedmore Transect.** Haslett *et al.* 2001a
	2140-1750	3600+/-70	Beta-142350	
	1620-1275	3190+/-70	Beta-142352	
Transition from Middle to Upper Somerset Levels Formation	1775-1515	3380+/-60	Beta-101741	**Rookery Farm, Axe valley**. Haslett *et al.* 1998a
	1765-1510	3370+/-60	Beta-101740	
	1690-1380	3250+/-80	Beta 101742	
Base of reed peat overlying estuarine clay	840-530	2590+/-50	GU-3246	**Godney Moor, Brue**, Housley *et al.* 2000
	810-450	2560+/-50	GU-3247	
Bottom of peat above estuarine clay	810-440	2550+/-50	Q-2458	**Long Run Farm, Brue** Housley *et al.* 2000
Top of peat before estuarine clay	1210-900	2860+/-50	Q-2459	
Bulk sample, reed peat ©	5440-5080	6340+/-70	Wk-5298	**Burnham-on-Sea.** Druce 1998
Base of peat (B)	4660-4340	5590+/-70	Wk-5297	
Base of peat (A)	4360-4000	5299+/-70	Wk-5299	
Top of peat (A)	3780-3370	4790+/-70	Wk-5300	
Peat	1682-1320	3220+/-70	Wk-9017	**Walpole, Somerset**. Hollinrake & Hollinrake 2002
Peat top	2296-1888	3710+/-70	Wk-9018	
Peat base	3503-3094	4570+/-60	Wk-9019	
Peat top	4672-4245	5580+/-100	Wk-9020	
Peat base	4781-4370	5750+/-80	Wk-9021	
Base of peat below main peat layer	4770-4460	5745+/-45	OxA-11233	**Shapwick Burtle.** Wilkinson 1999
Peat base Sutton Hams	3970-3660	5020+/-80	HAR-5354	**Central Brue valley**. Coles & Dobson 1989
Peat base Shapwick Heath	4611-4046	5510+/-120	Q-423	
Peat base Eclipse track	4448-4055	5440+/-70	HAR-4865	
Peat base Meare Village East	4315-3964	5270+/-70	HAR-7064	
Peat base Walton Heath	4680-4350	5650+/-70	HAR-1831	

Interpretation	Age cal. BC	RC years BP	Lab. code	Site and Reference
Base upper leaf fourth peat	1449-1100	3040+/-60	Beta-118378	**Rockingham Farm, Avonmouth** Moore *et al.* 2003
Top upper leaf fourth peat	1210-820	2810+/-70	Beta-118379	
Base lower leaf fourth peat	2880-2490	4073+/-55	NZA-15616	
Top lower leaf fourth peat	2900-2300	3966+/-60	NZA-15589	
Base upper leaf fourth peat	1880-1510	3352+/-60	NZA-15588	
Top upper leaf fourth peat	1320-920	2900+/-60	NZA-15587	
Base fourth peat	2580-2570	3917+/-55	NZA-15880	
Top fourth peat	1530-1370	3151+/-45	NZA-15879	
Base fourth peat	2860-2450	4045+/-50	AA-30868	**Pucklechurch to Seabank, Avonmouth**. Carter *et al.* 2004
Top fourth peat	2470-2450	3850+/-50	AA-30865	
Buried soil	1950-1050	3240+/-160	Wk-6234	
Buried soil	2130-1740	3670+/-60	Wk-6232	
Bottom of buried soil + occupation	5790-5590	6866+/-50	NZA-12479	**Katherine Farm, Avonmouth**. Allen *et al.* 2003
Top of buried soil with occupation	4910-4550	5879+/-70	NZA-12478	
Buried soil with occupation	1070-810	2778+/-55	NZA-12725	
	1380-1010	2957+/-55	NZA-12726	
Lower buried soil	2905-2500	4170+/-70	Beta-125794	**Cabot Park, Avonmouth**. Locock *et al.* 1999
Lower buried soil	2585-2280	3970+/-60	Beta-125795	
Upper buried soil	1760-1505	3350+/-60	Beta-134901	
Upper buried soil	1390-1100	2970+/-60	Beta-134900	
Top woody peat	1520-1220	3100+/-50	Beta-80696	**Slimbridge**. Hewlett & Birnie 1996
Top woody peat	800-200	2340+/-60	Beta-80693	**Longney**. Hewlett & Birnie 1996
Top woody peat	800-200	2360+/-60	Beta-81686	**Elmore.** Allen 2001a
Upper peat (upper salt marsh)	895-674	2630+/-50	Not quoted	**Withy Bridge, Huntspill**. Vickery 1999
Lower peat (upper salt marsh)	1523-1311	3160+/-50		

11 Mapping of borehole data

11.1 Borehole and auger surveys have been undertaken in the Severn Estuary for both engineering and archaeological purposes and these can provide data about buried deposits and their potential to answer archaeological questions. In particular buried peat layers may yield palaeoenvironmental data which relate not only to past environments, but also to former sea-level (Kidson & Heyworth 1973, Heyworth & Kidson 1982, Hewlett 1997, Druce 2001).

11.2 The presence of boreholes is poorly recorded in the HER/SMRs for the RCZA survey area but those for Somerset were provided by Richard Brunning. The British Geological Survey holds a record of boreholes undertaken for geological purposes, which is available on-line via their GeoIndex :

http://www.bgs.ac.uk/geoindex/index.htm

although this is not available in a format which allowed integration within the RCZA database/GIS framework. For this reason boreholes were not mapped within the project GIS, but relevant locations are noted below.

11.3 The majority of BGS data relates to engineering work at Oldbury, Berkeley and Hinkley Point Power Stations and around the Second Severn Crossing, though of particular interest to the RCZA are a series of boreholes taken at Frampton on Severn, Arlingham and Newnham and along the coast at Sand Bay. The sea defences at Burnham and Watchet were also surveyed, although the utility of engineering boreholes, and their associated logs, to archaeological work is questionable. An assessment of the quality of the borehole logs was beyond the scope of Phase I RCZA work and an audit, targeted at pilot Phase II fieldwork sites should be undertaken to assess the usefulness of the data for the main fieldwork phase.

12 Digitising of cartographic data from historic OS mapping

12.1 In order to understand recent change to the coast of the Severn Estuary, the coastline as shown on historic Ordnance Survey maps was digitised into a GIS (Figures 28 to 31). A complete coverage of 1:10,000 scale digital maps for the RCZA survey area was supplied by Landmark. The 1880 and 1925 Editions were initially chosen as being suitable for digitising, but the 1925 mapping was found to be incomplete. The only coverage which was complete was that from the 1900 Second Edition, which was digitised instead of the 1925 Third Edition.

12.2 High Water and Low Water were digitised at 1:3,500, the scale being chosen because the quality of the scans was poor below this resolution. The scale also avoids spurious accuracy. Inlets were digitised up to the 1km limit from High Water which defines the RCZA survey area.

12.3 Problems encountered during the digitisation process were generally associated with the ways in which the historic mapping had been scanned and tiled by Landmark. In particular, edges of individual sheets did not always match and, in some cases, the coastline was displaced by as much as 20m. In this situation, the digitisation took a middle line through any edge discontinuities.

12.4 A further problem with the survey area generally was the coincidence of High and Low Water above Bollow. The river above Sharpness is not charted and the tidal range here is very narrow, as a result it was not possible to accurately digitise both High and Low Water. As a compromise, Low Water was digitised accurately and High Water digitised inland of this at an arbitrary distance of 3-5m.

12.5 It was not possible to be certain if minor changes in the line of High and Low Water were due to cartographic errors and slight differences in the way in which the maps have been georeferenced/digitised. As a result, very minor change was ignored in the resulting analysis of coastal change.

12.6 The FutureCoast survey undertaken by Halcrow (see below) had already looked at this data in more detail and produced models of shoreline change as a result. These models should be accurate and are assessed below.

13 The modern and projected future nature of the coast: Summary of FutureCoast data

13.1 The FutureCoast survey was carried out by Halcrow on behalf of DEFRA and the CD of the results of the survey contains 51 pages of detailed information about projected coastal change within the Severn Estuary (as far north as the Old Severn Crossing) over the next 100 years. The document also deals with the morphology and historic change of the coast. A series of Shoreline Behaviour Statements have been complied for the estuary, which take into account the evolution, physical controls and linkages and human intervention along the coast, which are used to compile an assessment of the characteristics and behaviour of stretches of the coast classified as Coastal Behaviour Systems. These reports are summarised below.

13.2 The FutureCoast study identified two coastal behaviour systems within the RCZA survey area. These consist of the Bristol Channel South (Morte Point to Brean Down) and the Outer Severn Estuary (Brean Down to Penarth). The southern shore of the Channel was considered as three main units: Morte Point to Minehead, Minehead to Hinkley Point and Hinkley Point to Brean Down, whereas the estuary was considered to consist of four units: Brean Down to the River Yeo, Clevedon to Portishead Dock, Portishead to Old Severn Bridge and Old Severn Bridge (Beachley Point) to Penarth.

13.3 The section of coast between Porlock and Minehead (Figure 13) is described an east-west trending hard rock coast composed primarily of sandstones, slates and shales, the indentation of which is controlled by lithological and structural variation of the rocks. Porlock Bay is underlain by relatively soft mudstones and breccia (broken, angular rock fragments), with harder sandstones forming the surrounding higher ground. Porlock Ridge has had a complex history of build-up and breakdown, largely controlled by the rate of sea level rise and availability of sediment from the west. A large proportion of the gravel contained in the Porlock barrier system is thought to have been derived from head deposits that covered Porlock Bay following the last glacial episode.

13.4 Much of the open-cliffed coastline in this section of coast is undefended, with defences being restricted to individual embayments. Where defences are present, principally in the form of seawalls, they protect localised areas from flooding and erosion. The gravel barrier in Porlock Bay has been subjected to extensive human intervention to try to maintain its coherence and protect the back-barrier zone from flooding. This has involved groyning to retard longshore sediment flux, and artificial build-up of the barrier crest. Despite this, the shingle ridge breached in 1996, has not been repaired and there is now extensive tidal flooding. Whilst this has obvious implications for future shoreline development within Porlock Bay, little impact is anticipated for the behaviour of the wider coastline.

13.5 The cliffs between Porlock and Minehead are anticipated to display regionally low rates of erosion, with little change over the next century.

13.6 The section between Minehead and Hinkley Point (Figures 11 and 12) is described as predominantly cliffed and being essentially erosional, having retreated throughout the Holocene, leaving a wide intertidal platform. Landward movement of the MLW line of over 300m has been reported at Ker Moor during the last century, decreasing to 100m in the eastern side of Blue Anchor Bay. An extensive low-lying area of former saltmarsh and river terrace deposits has developed between Minehead and Blue Anchor (Figure 12) following enclosure by a gravel storm ridge, the source of the gravel being erosion of the cliffs to the west of Minehead. Between Warren Point and Dunster, the ridge is backed by dunes which formed prior to the development of the ridge.

13.7 Although the majority of the cliffed coastline is undefended, management practices in Blue Anchor Bay have constrained the natural tendency for landward migration of the gravel

storm ridge, artificially holding the shoreline seaward of its natural position. Defences at Warren Point and the adjacent frontage at Minehead to the west, also hold the shoreline as an artificial seaward protuberance. The resulting projected large-scale evolution of this stretch of coast is that it will continue to erode as it has done throughout the Holocene, with rates varying depending upon the differences in the underlying geology. Blue Anchor Bay would develop into a wider and deeper embayment, constrained to the northwest by the cliffs at Minehead Harbour and to the east at Blue Anchor. The gravel ridge between Minehead and Blue Anchor would display a natural tendency to migrate landward and to redistribute itself eastwards along the shoreline. The ridge would be subject to breakdown and there would be subsequent flooding of the low-lying area, extending west to Minehead. Where dunes back the ridge, they would afford a natural defence that could temporarily halt retreat of the ridge and supply sand to the foreshore. However, the dunes would eventually be lost due to longshore drift and a lack of fresh sediment supply.

13.8 The mudstone cliffs between Blue Anchor and St Audrie's Bay (Figure 12) would be expected to experience continued erosion but the cliffs between St Audrie's Bay and Hinkley Point would be expected to show lower rates of cliff recession, with little change over the next century.

13.9 Between Minehead and St Audrie's Bay, the coastline is described as cliffed and incised into Triassic shales and limestones and Jurassic mudstones, fronted by a wide intertidal rock platform. Variable spreads of mud, sand and gravel cover this platform. Cliff falls have been a recurrent problem along this stretch of coast, with the undefended cliffs to the east of Blue Anchor displaying a moderate rate of retreat, with low rates at Watchet and moderate rates in Helwell Bay. Unprotected mudstone cliffs in St Audrie's Bay are retreating by large-scale debris sliding and the cliffs incised into head deposits between Watchet and Doniford have been subject to rapid recession by debris flow and rotational sliding. To the west and east of Watchet harbour, defences have restricted erosion of the cliff, although MHW line has moved landward. St Audrie's Bay has seen a seaward shift of the MLW line, suggesting a widening and flattening of the foreshore due to a significant input of sediment from the cliffs.

13.10 The potential rates of cliff recession vary according to the bedrock geology, with higher relative erosion expected at Watchet, Doniford and St Audrie's Bay over the next century under an unconstrained scenario. Cliff recession at Watchet could initially be more rapid than for the adjacent coastline but is only likely to be significant in the short term. The remaining cliffed coastline to St Audrie's Bay would expect to see continued retreat, possibly leading to the development of a more pronounced embayment.

13.11 Between St Audrie's Bay and Hinkley Point the coast is characterised as a low cliffed coastline comprising predominantly Triassic shales and limestones, fronted by a wide intertidal rock platform. Extensive intertidal mud and sand flats occur from Lilstock to Hinkley Point and small, potentially floodable areas exist between the low cliffs at Kilve Pill and Lilstock. The cliffs between Quantoxhead and Lilstock have shown little historical change in cliff top position and the cliffs between Lilstock and Hinkley Point show equally low rates of recession. These low rates would be expected to continue between St Audrie's Bay and Lilstock and between Lilstock and Hinkley Point. The foreshore throughout this frontage would be expected to show an overall stability, with fresh sediment inputs balancing the retreat which will be driven by ongoing sea-level rise. The extensive rock platforms will also assist in maintenance of foreshore protection for the backing cliffs.

13.12 From Hinkley Point to the River Parrett (Figure 11) the coast is composed of Holocene estuarine and marine sediments. Analysis of historical maps as part of the FutureCoast project indicated that during the past century the MHW line has retreated at Stolford, although only by a few metres, whereas for the rest of the shoreline to Stert Point there has been advance, of about 60m at Catsford Common and 200m at Steart, associated

with salt marsh colonisation since 1928. Despite seaward movement of the MHW line, there has been retreat of the MLW line and foreshore steepening along this frontage. The MHW line at Stert Point has been subject to movement of hundreds of metres during the past few centuries. Until the late 18th century, the peninsula extended to Stert Island, becoming breached sometime prior to 1802. The predicted changes to the coast here are complex, but could result in the formation of a new tidal inlet or the breaking through of the River Parrett and the movement of this part of the coast to the west.

13.13 Between the River Parrett and Brean Down (Figures 10 and 11), the coast is characterised by a system of dunes, up to *c.*800m wide and reaching heights of over 10m. Analysis of historic maps indicates that two islands existed in the mouth of the River Parrett Estuary until the late 18th century, one of which remains as East Dunball Point (west of Huntspill). Stert Island was formed by the breaching of the Stert peninsula prior to 1802. During the 1980s, the outer River Parrett channel developed a northerly course than previously. The mechanism for the switch in channel position is unknown and future patterns of movement are difficult to predict. The frontage from Burnham-on-Sea to Brean has experienced a complex pattern of shoreline change during the past century, but overall has been subject to shoreline retreat with the dunes actively eroding, their seaward faces retreating landward due to wave attack. At Berrow, however, the pattern of shoreline change is accretional, and an elongated area of salt marsh has developed since *c.*1910, which has moved the shoreline seaward by *c.*275m. During the 1960s the marsh was frequently tidally inundated, but subsequently a narrow series of foredunes formed to almost entirely isolate the marsh from the sea. These recent dunes are now subjected to erosion, and the width of the marsh is being reduced as the dunes migrate landwards. Severe erosion of the southern end of these dunes has been reported in recent years.

13.14 Historical map analysis indicates a seaward shift in the MHW position at Burnham-on-Sea during the past century (although this could be related to the replacement of defences), with a fluctuation in the position of the MLW line indicating possible foreshore steepening. The trend of seaward accretion is evident at Berrow, with seaward movement of the MHW line of up to 300m associated with salt marsh development. Continued erosion of the dunes at Berrow is likely, although they are not likely to be breached during the next 100 years. Without management intervention, the frontage of Burnham-on-Sea could be subject to erosion and inundation of the low-lying hinterland. The probability of this occurring will depend, to some extent, upon future evolution of the River Parrett channel, but is considered unlikely over the next century.

13.15 The coast between Brean Down and Worlebury Hill (Figure 9) is a dune-backed embayment, flanked by Carboniferous limestone headlands. Landward of the dunes is a low-lying area of predominantly estuarine and marine alluvium, forming part of the Severn Levels and linked to the Levels south of Brean Down by the floodplain of the River Axe. The foreshore comprises a wide sandy beach, grading to mud on the extensive tidal flats, which extend up to 2km offshore. Saltmarsh has developed to the east of Brean Down, at the mouth of the River Axe. The northern side of Brean Down shows evidence of foreshore lowering during the past century, with increasing exposure of the intertidal rock platform which measured up to 40m wide at Fiddlers Point by the 1980s. The position of MHW has, however, remained stable due to the resistant nature of the bedrock. In the central bay, historic mapping indicates a seaward movement of the MHW mark of *c.* 50m since the 1880s. Over the long term, erosion and landward migration of the dune ridge would be expected to occur, with the northern end of the bay, in particular, having the potential to experience accelerated erosion if there was an increase in westerly storm wave activity. With breakdown of the dune ridge, low-lying areas would be subjected to extensive marine flooding, potentially extending south across the mouth of the River Axe to the Levels, south of Brean Down. Under such a scenario, Brean Down would be likely to become an island seaward of the new shoreline. The headland cliffs along this shoreline would be expected to continue to display low recession rates over the next hundred years, however.

13.16 The area of Sand Bay, between Worlebury Hill and Sand Point (Figure 9), is an embayment similar in morphology to that of Weston Bay to the south, lying between the resistant Carboniferous limestone headlands of Swallow Cliff in the north and Worlebury Hill in the south. A narrow dune belt backs the embayment. The foreshore comprises a wide sandy beach, grading to extensive muddy intertidal flats. Saltmarsh has developed at the northern end of the embayment, immediately to the south of Swallow Cliff, with an intertidal rock platform extending west along the headland to Sand Point. The cliff headlands are fronted by rocky intertidal platforms, with gravel and boulders covering the platform on the northern side of Worlebury Hill. At Worlebury Hill, local cliff failures and rock falls have resulted in a seaward movement of MHW due to eroded coarse-grained sediment remaining on the rock platform. In the central bay, however, MHW and MLW marks have remained similar to their positions in the 1880s. At the extreme northern end of the bay, MHW has moved seaward by *c.* 450m since the 1880s due to the accumulation of intertidal mud and salt marsh. This section of shoreline would be expected to experience erosion under westerly storm wave activity, leading to lowering of the foreshore level. Erosion and landward migration of the dune ridge would also be expected to occur, leading to breakdown due to a continued low sediment supply. A breach of the natural defence would lead to extensive marine flooding of the low-lying areas, potentially extending eastward to the Levels backing Woodspring Bay. Under such a scenario, Middle Hope would be likely to become an island. The headland cliffs would be expected to continue to display low recession rates over the next hundred years.

13.17 Between Sand Point and St Thomas's Head (Figure 9), the cliffed coastline is composed of resistant Carboniferous limestone, forming a headland separating Sand Bay to the south from Woodspring Bay to the east. The foreshore comprises an intertidal rock platform, with a mud covering on the eastern part. There is no evidence for significant production of sediment from the cliff erosion along this section of the coast at the present time. The resistant cliffs and rock platform would be expected to show continued low rates of recession over the next hundred years. With inundation of the low-lying Levels to the south and east, Middle Hope would be likely to become an island, although it would still exert control over the leeward shoreline by providing protection from direct wave activity from the north-west.

13.18 The stretch of coast between St Thomas's Head to the Blind Yeo and Clevedon (Figure 9) is a low-lying embayment between resistant Carboniferous limestone outcrops. An extensive low-lying hinterland of marine and estuarine alluvium backs the embayment, forming part of the Severn Levels and extending westward across the mouth of the Rivers Yeo and Banwell to Sand Bay. The backshore comprises salt marsh, fronted by wide intertidal mudflats. There has been a general erosional trend within the bay since the 1880s, with a 40m to 100m reduction in foreshore width. To the south of Wain's Hill at the mouth of the Blind Yeo, variable saltmarsh progradation of up to 200m has occurred during the past century. Over the long term, landward recession of the shoreline and the creation of a wider intertidal zone could be expected with inundation potentially extending westward to the lowland behind Sand Bay.

13.19 From Clevedon to Portishead Dock (Figure 8), the cliffed coastline is composed of resistant Carboniferous limestones and mudstones with Devonian sandstone. A patchy cover of dolomitic conglomerate extends from below sea level to the top of the cliff. Between Walton in Gordano and Portishead, the ridge fronts a broad low-lying area of head and estuarine alluvium and peat, which has formed on weaker mudstones in a fault-controlled depression. Rates of cliff retreat along the foreshore have been low. Fragments of raised beach exist along the coastline, representing former Pleistocene positions of higher relative sea level at *c.* 3m and 15m levels. The coastline here would be expected to display low rates of recession with little change over the next hundred years. Localised rock falls could continue to supply small quantities of gravel to the foreshore predominantly between Clevedon Pier and Ladye Bay, although limited redistribution would be expected, with rock platform dominating the foreshore along much of the frontage. The saltmarsh in Woodhill Bay

could erode along the marsh with inundation of a small area of lowland. Shoreline recession could lead to saltmarsh squeeze, with landward migration constrained by the backing cliffs

13.20 Between Portishead Dock and the Old Severn Bridge (Figures 7 and 8), the coastline is predominantly low lying, having developed between resistant dolomite and sandstone cliffs, to the south-west at Portishead Dock, and mudstone cliffs to the north-east of Old Passage. As with the estuarine margins throughout the rest of the estuary, the lowland sediments were deposited as marine and estuarine alluvium during the Holocene, as sea level rose to its present position. An earlier Pleistocene course of the River Severn flowed to the east of Severn Beach, with a westerly stream excavating the deep channel of The Shoots. Later interglacial obstruction diverted the river westward toward the present channel position, further eroding The Shoots. The resistant bedrock outcrops at English Stones and Lady Bench remained as mid-estuary constrictions to the main channel. Similar control points exist further upstream at Aust Rock and Beachley Head. English Stones has acted as a control over shoreline recession at New Passage, leading to its development as a promontory. Human modification due to land reclamation and sea defences has significantly altered the extent, elevation and form of the defended lowlands and historic trends on this frontage indicate relative stability of the lowland shoreline, with considerable accretion in some areas. When considering recent changes, however, it is important to recognise that trends identified may not necessarily reflect the longer-term erosional and depositional phases that the shoreline experiences. Extensive marine flooding of the lowland Levels between Portishead Dock and Old Passage is predicted by FutureCoast, with accompanying landward recession of the shoreline, creating wider intertidal areas. The cliffs, such as Aust Cliff, would, however, be expected to continue to display low rates of cliff recession during the next century. Sea level rise and increased local wave energy could lead to potentially higher rates of erosion, but the cliffs would be expected to remain largely unchanged.

14 Coastal management – Shoreline Management Plans and the Tidal Severn Flood Risk Management Strategy

14.1 The existing Shoreline Management Plan (SMP1) for the Severn Estuary was compiled by the Severn Estuary Coastal Group and Gifford Associated Consultants in 2000. The Severn RCZA survey area is included in 2 plans, The North Devon and Somerset Coast SMP and the Severn SMP. The SMP2 process is now underway in SW England. The following summary is based on SMP1 which divided the area into 22 Process Units (PUs), each characterised by similarities in natural processes (Figure 31).

PUs 1 to 6 lie outside the RCZA survey area, but the remaining units are summarised below.

PU7: Severn Crossings occupies an area of generally low lying land (with the exception of Aust Cliff and Beachley Point), and the mouth of the River Wye lying to the west of Beachley Point on the west bank.

PU8: The River Wye is largely outside the RCZA survey area but the area between Sedbury and Beachley is included within this survey. This is low-lying agricultural and recreational land.

PU9: Beachley to Sharpness has extensive areas of low lying land with Berkeley and Oldbury power stations located on the east bank. The unit lies between the two constrictions in the width of the estuary at Beachley/Aust and at Lydney/Sharpness. Offshore, there are large intertidal sand banks and rock exposures which influence the low tide channel.

PU10: Sharpness to Purton consists mainly of Devonian and Jurassic mudstone cliffs and the coastline here has been relatively stable over the last 100 years. The majority of this process unit does not lie within a flood risk area, except for low-lying land at Purton, west of Tites Point (left bank). The unit comprises mainly Devonian mudstone cliffs with outcrops of Jurassic mudstone cliffs at the northern extent of the unit (at Purton and Cotterday Hole).

PU11: Tites Point to Hock Cliff is characterised by low lying ground, in particular Slimbridge Warth and New Grounds. The downstream boundary relates to the great increase in the width of the estuary upstream of Tites Point. The upstream boundary relates to the transition from the more open estuary with long fetches in this unit to the meandering tidal river in PU12 and upstream.

PU12: Hock Cliff to Longney Pool takes in the Arlingham Peninsula and is characterised by low alluvium and sedimentary deposition environments. The right bank of this section fluctuates between erosion and accretion.

PU13: Longney Pool to The Weirs. Consists of mainly low lying land to the west and north of Gloucester.

PU14: The Weirs to Haw Bridge includes both banks of the Severn and is predominantly fluvial, rather than estuarine in nature. This PU lies to the north of the RCZA survey area.

PU15: New Passage to Portishead is backed by extensive areas of low lying land (the Avon Levels), which are defended by continuous flood banks.

PU16: The River Avon: from the mouth of the Avon to Netham Weir. Most of this unit lies outside the RCZA area.

PU17: Portishead to Clevedon. Extends from Portbury Docks to Wains Hill. The unit is a cliff lined north-west facing shoreline with a narrow intertidal width. The boundary of the

unit near the Old Pier to the west of Portbury Docks marks the transition from the cliff coast in this unit to a low lying shoreline of estuarine alluvium which then extends to Avonmouth (PU16 and PU15). The south-western boundary of this unit marks the southern limit of the rocky cliffs and wave cut platform at Wains Hill.

PU18: Kingston Seymour. Stretches from Wains Hill in the north to St Thomas' Head in the south. Wains Hill marks the transition from the cliff coast PU17 to a low-lying shoreline of estuarine alluvium which then extends to St Thomas' Head

PU19: Middle Hope from St Thomas Head to Sand Point. The unit boundaries are defined by the seaward limits of the carboniferous limestone headlands in the west and east. The unit has steep cliffs, with a narrow rocky intertidal area. The central section, the area of Middle Hope, comprises a 2.4km ridge which rises to a height of 43m. To the rear of the ridge is low lying estuarine alluvium.

PU20: Sand Bay stretches from Sand Point in the north, to Birnbeck Island in the south. These headlands at each end of the bay comprise hard rock geology of carboniferous limestone. The bay faces westwards and it has a wide intertidal area of sandbanks and mud flats, which dry out to a line between the headlands. Sand dunes form the backshore and form part of the line of sea defence. There is a large saltmarsh at the northern end of the bay.

PU21: Weston Bay is defined by the hard rock headlands of Birnbeck Island in the north and Brean Down in the south. The unit is a westward facing bay with a wide mud intertidal area and a sandy foreshore. At the southern end of the process unit the River Axe discharges into the Severn between Uphill and Brean Down. The unit extends up the River Axe as far as the tidal limit of Brean Cross sluice.

PU22: The Holms comprises the two small islands of Flat Holm (Wales) and Steep Holm (England), which are located at the southern boundary of the Severn Estuary SMP. Flat Holm has 2km shoreline length and is 26m at its highest point. The island lies between Lavernock Point on the Welsh coastline and Brean Down on the English coastline. Steep Holm lies 4km south of Flat Holm, it has a shoreline of 2km and is 72m at its highest point. The two islands are formed of carboniferous limestone.

The SMP for Bridgwater Bay to Bideford Bay was compiled by the North Devon and Somerset Coastal Group and Halcrow in 1998. The SMP identified a further 20 Management Units, seven of which lie within the RCZA survey area. These are:

Unit BURN: River Brue to Brean Down is characterised by beach-tidal flats, backed by sand dunes. The beach flats extend for up to 4km seaward.

Unit PARR: Hinkley Point to River Brue covers the south side of Bridgwater Bay and includes the River Parrett as far upstream as Combwich. The coast here consists of open coast and wide intertidal beach flats, backed by low shingle ridges. A wave-cut platform at Hinkley Point and Stolford forms the only natural hard points on an otherwise soft coastline.

Unit LILS: St Audrie's Bay to Hinkley Point is a more or less continuously cliffed backshore fronted by a wide (up to 500m) wave-cut platform, on which a narrow shingle storm beach rests.

Unit WATC: Blue Anchor to St Audrie's Bay consists of cliffs, fronted by a foreshore wave-cut platform. The differential erosion of the softer mudstone bedrock here has created a series of bays, along which sporadic development has taken place, including a small port at Watchet and a number of holiday camps.

Unit MINE: Minehead to Blue Anchor extends from Culver Cliff, west of Minehead to the east of Blue Anchor. The majority of this unit is low-lying and potentially vulnerable to flooding. Sand dunes are located between Minehead and Dunster and these are protected by an artificially recharged shingle ridge. Between Dunster and Blue Anchor there is a wide, crescentic shingle beach, with sandy intertidal deposits comprising the foreshore between Minehead and Dunster.

Unit SELW: Porlock Bay to Minehead extends from Hurlstone Point to Culver Cliff and is characterised by sandstone and mudstone cliffs which are undeveloped and fall within the administrative area of the Exmoor National Park. A narrow beach is located at the base of the cliffs.

Unit PORL: Porlock Bay extends between Gore point and Hurlstone Point and is dominated by a segmented shingle storm beach, protected by a shingle ridge. This ridge was breached in a storm in October 1996, leading to the formation of a shallow saline lagoon.

14.2 Areas which have been identified as needing active intervention (i.e. where retreat the line (including managed retreat) and advance the line are identified as longer-term objectives) in the SMP are listed below. Archaeological deposits in these areas may be under threat. Although the option of hold the line may involve active management of existing flood defences, this is less likely to have an impact on archaeological sites and deposits.

14.3 Retreat the line is the provisional alternative option in the following units:

7/2 Black Rock to Thornwell

7/5 Old Passage to New Passage

9/3 Sturch Pill to Guscar Rocks

9/4 Guscar Rocks to Lydney Harbour

9/5 South of Sharpness to Berkeley Pill

9/7 Berkeley Power Station to Chapel House

9/9 Oldbury to Littleton

11/2 Whitescourt to Hayward

11/3 Hock Ditch to Frampton Breakwater

11/4 Frampton Breakwater to the Dumbles

11/5 the Royal Drift

12/1 Hayward to Northington Farm

12/3 Portlands Nab to Newnham

12/6 The Dumballs

12/8 Priding Wick Court to Longmarsh Pill

13/2 Noard's Point to Hartland's Hill

13/5 Minsterworth Ham

13/6 Moorcroft to the Lower Parting

13/7 Lower Parting to Maisemore Weir

13/11 Windmill Hill to Elmore

13/12 Elmore

13/13 Elmore to Wicks Green

13/14 Wicks Green to Longney Crib

15/1 New Passage to Severnside Works

15/2 Severnside Works to Mitchell's Salt Rhine

15/3 Mitchell's Salt Rhine to Avonmouth

17/1 Old Pier Portishead to Portishead Point

17/3 Kilkenny Bay to Redcliff Bay

17/5 Clevedon

18/1 Wains Hill to St Thomas's Head

20/2 Middle Hope to South Kewstoke

20/3 South Kewstoke to Birnbeck Island

21/2 Weston-super-Mare to Uphill

21/3 River Axe

14.4 In PARR6 (Pawlett Hams to River Brue), the policy is hold the line, but localised managed retreat options were not ruled out.

14.5 In all cases of possible retreat the line, a programme of observation and monitoring is recommended in the first instance to in order to understand ongoing coastal processes. The need for further, strategic, study of potential future changes between Bideford Bay and Bridgwater Bay and in Bridgwater Bay itself were also identified in the Bridgewater Bay to Bideford Bay SMP.

14.6 Although the upper limit of the FutureCoast survey was the Severn Crossing, the area between Avonmouth and Maisemore Weir was covered by the Environment Agency's *Tidal Severn Flood Risk Management Strategy* (TSS). This Strategy aimed to provide a 50 year framework for managing the flood risk in this area, reviewing the current flood defences and suggesting improvements, where necessary. As such, the survey was intimately tied-up with both the Severn Estuary Shoreline Management Plan (SMP) and the Coastal Habitat Management Plan (CHaMP). The TSS divided this area into 39 Management Units, which were considered to possess similar geomorphological, drainage and fluvial/tidal influence patterns, and which fell within 9 Process Units identified by the SMP. The majority of the future policies for coastal defence over the short term identified in the TSS involve "holding the line", with "retreat the line" the long term policy for only three areas (Saniger Pill to Berkeley Pill, Northington to Awre and Awre to Hagloe), although "hold the line with local retreat" was identified as the short term policy for the area between New Passage and New Pill. "Hold the line or retreat the line" was identified as the long term policy for 21 areas (53% of the total).

14.7 The possibility for managed retreat of the defences, enabling restoration and enhancement of floodplain habitats and intertidal saltmarsh was identified in the following areas. The CHaMP will identify if these are viable options.

13A East: Llanthony Weir to Rea

13D East: Windmill Hill to Waterend

13E East: Waterend to Longney Crib

12C East: Priding to Hock Cliff

11A East: Hock Ditch to Splatt Bridge

11B East: Splatt Bridge to Royal Drift Outfall

9A East: Saniger Pill to Berkeley Pill

9B East: Berkeley Pill to Hill Pill

9C East: Hill Pill to Oldbury Pill

9D East: Oldbury Pill to Littleton Pill

7A East: Littleton Pill to Old Passage

13B West: Over Bridge to Highcross Farm (Minsterworth and Corn Ham).

13C West: Highcross Farm to Oakle Street

13E West: Walmore Common to Bullow

12A West: Rodley to Garden Cliff

12B West: Garden Cliff to Broadoak

12E West: Northington to Hayward

11A West: Hayward to Hagloe

PORL3: Porlock to Hurlstone Point

14.8 The possible realignment of defences was identified in the following areas:

12B East: Cobbles Rock to Priding

9A East: Saniger Pill to Berkeley Pill

9D East: Oldbury Pill to Littleton Pill

7B East: Old Passage to New Passage

15A East: New Passage to New Pill

15B East: New Pill to Mitchell's Salt Rhine

PARR3: Stolford to Fenning Island

PARR4: Fenning Island to Combwich Common

WATC3:Watchet Harbour to Helwell Bay

WATC4:Helwell Bay to Doniford

MINE3:The Warren

MINE4: Dunster Beach Holiday Park

MINE5: Ker Moor

14.9 New defences are proposed in area 15C East: Mitchell's Salt Rhine to Customs House (Avonmouth) and also in 13B West upstream: Over Bridge to Highcross Farm.

15 Identification of areas of deposition and erosion within the Severn Estuary

15.1 The data collated by the FutureCoast survey gives a very good indication of where the coast will move in the next 100 years, if unconstrained, and identifies the level of impact this will have. A further major study undertaken by Posford-Duvier (2000) is more concerned with large scale sediment movement and does not have a high degree of relevance to this study.

15.2 FutureCoast identifies the potential magnitude of change in shoreline position in the next 100 years, which is presented in five bands:

- *Extreme*: greater than 200m change
- *Very High*: 100 to 200m change
- *High*: 50 to 100m change
- *Moderate*: 10 to 50m change
- *Negligible/ no change*: less than 10m change

15.3 For the purposes of the RCZA, Very High and High were considered together, Moderate was mapped, but areas of negligible/ no change were not mapped (Figure 33). Although there are some substantial areas of little or no change mapped by FutureCoast, there are no areas identified where the coast is moving seawards, net coastal change is thought to be inland during the next 100 years.

Areas of high potential change were identified as

- Porlock Bay
- Blue Anchor Bay
- the coast east from Hinkley Point to Weston-super-Mare (excluding Brean Down)
- Sand Bay

15.4 The only area of Moderate potential change was identified as the stretch of coast from the east of Blue Anchor Bay to St Audrie's Bay.

15.5 Areas mapped as "major change in landform" occurred in Woodspring Bay (between Woodspring Priory and Clevedon) and along the North Somerset coast between Portishead and Aust. These areas are also identified as "Hotspots", where there is potential for a major change in morphological form or a breakdown of an existing morphological form.

15.6 Low to Medium Hotspots were identified in Porlock Bay and from Sand Point to St Thomas' Head. Medium to High Hotspots were identified between Minehead and Blue Anchor, Hinkley Point to Sand Point, St Thomas' Head to Blind Yeo and Clevedon to Old Passage.

15.7 In many ways it is easier to identify those areas of the coast which are not affected by some sort of coastal process (either natural or anthropogenic), as the areas which are affected by change are so extensive. Areas not potentially affected by change are:

- The hard rock coast between Selworthy Beacon and Minehead

- The low cliffs between Watchet and Hinkley Point (although Blue Anchor to St Audrie's Bay has been identified as under moderate potential change)
- Brean Down and Worlebury
- Sand Point to St Thomas' Head
- Clevedon to Portishead
- Sharpness to Purton
- Broadoak to Northington
- Hagloe to Beachley

15.8 Although these areas have been identified as not potentially under threat, ongoing processes in the intertidal area do, potentially, threaten all sites in this location throughout the estuary. Similarly, such processes constantly reveal new sites in these locations.

16 Identification of specific sites and areas which would benefit from further research or fieldwork

16.1 All of the areas of known deposits and of high archaeological potential identified in Section 8, with the exception of Brean Down, lie in areas which are potentially affected by coastal change.

16.2 The NMP has identified large numbers of previously unrecorded fishing structures in Blue Anchor/Minehead Bays. These are located close to an area of few HER/SMR records at Dunster Beach/Blue Anchor Bay and require further fieldwork to assess their survival, condition, dating and preservation.

16.3 The area between Stert Flats and Berrow Flats is under high potential threat and Berrow Flats in particular are poorly understood, although the NMP did record fishing structures and at least two wrecked vessels in the intertidal zone here. This is also an area previously identified as having high archaeological potential. Weston Bay and Sand Bay are similarly poorly understood (but were not covered by the initial NMP survey undertaken for RCZA Phase I). Berrow Flats, Sand Bay and Weston Bay should be targeted for further survey and fieldwork although safety issues are likely to restrict pedestrian access to these areas.

16.4 The area around Woodspring Bay, Blackstone Rocks and Wains Hill is under particularly high threat due to coastal change and is an area which has produced evidence for Mesolithic occupation. Although the peats here have been sampled, the context of the lithics recovered by Sykes (1938) are poorly understood. Work in Woodspring Bay may also complement proposed work in Sand Bay and Rippon's work at Kingston Seymour (Rippon 2004), as well as potentially helping to understand the landscape setting and exploitation of Woodspring Priory. Woodspring Bay is also an area previously identified as having high archaeological potential.

16.5 The area to the north and south of Avonmouth is likely to undergo major changes and these includes areas where previous work has identified important archaeological deposits in both the intertidal and terrestrial parts of the estuary. The area around English Stones/Second Severn Crossing has a high number of fish traps, identified by Allen (2005), and work here would compliment proposed work on fish traps in Blue Anchor/Minehead Bays. The fish traps identified by Allen (2005) at Horse Pool, Oldbury Flats as being unique to the Severn also require further work. Work in the intertidal zone here might also contribute to the understanding of the prehistoric and Roman sites in the North Somerset Levels.

16.6 Virtually all of the coast between Purton and Gloucester and Gloucester to Minsterworth has been identified as being under high potential threat and this is also an area which has produced much archaeological evidence. The sequence of reclamation here needs further work, as does the nature and date of the Great Wall of Elmore. The area of Frampton Sand/New Grounds has few HER/SMR records and that around Minsterworth Ham is also poorly understood.

16.7 The section of coast from Rodley to Broadoak is an area of poorly understood reclamation and was also a focus for medieval and post-medieval fisheries. Fish traps are present in the intertidal zone at Broadoak, but this is an area with low numbers of SMR/HER records. Similarly, the area around Awre requires further work in understanding the reclamation sequence and the nature and date of the archaeological deposits recovered by Allen and Fulford (1987) require clarification.

16.8 Although the fish house at Collow Pill is a Grade II listed building, the location of that at Hawkins Pill is unknown and may benefit from survey work.

16.9 Although Lydney Level has been discussed at length by Allen (2001b) this section of the coast has also been identified as having exceptionally rapid coastal erosion (Allen 2000) and should be targeted for further survey.

16.10 The area of Tidenham and Sedbury has few SMR/HER records, but is located close to an area which has produced valuable environmental sequences, alongside *in-situ* archaeological deposits at Woolaston. A survey of this area for similar deposits would be of value.

16.11 Survey of the barrow or windmill mound identified by lidar survey would allow its origin to be examined (Truscoe 2007).

16.12 The wrecked vessels in the estuary could benefit from further survey work. Paul Barnett (pers comm.) suggests that there are at least 81 vessels in the Purton area and a further 13 at Lydney, only some of which have had detailed surveys carried out.

16.13 Digitising the historic charts of high potential should be considered as an appropriate early task within Phase II. These include the 1832 survey of the Severn by Commander Denham, the subsequent resurvey of 1849 by Captain Beechly and the 1853 survey by Commander Alldridge. These are located in the National Hydrographic Office in Taunton, although a duplicate of the Beechly chart is held by Gloucester Record Office.

17 Bibliography

ApSimon, A., 1965. The Roman temple on Brean Down, Somerset. *Proceedings of the University of Bristol Spelaeological Society* **10**, 195-258.

ApSimon, A., 2000. Brean Down Sand Cliff Revisited: Pleistocene Stratigraphy, New Finds and the Date of the Maritime Bell Beaker. *Proceedings of the University of Bristol Spelaeological Society* **22(1)**, 53-80.

ApSimon A.M. & Donovan, D.T., 1956, Marine Pleistocene deposits in the Vale of Gordano, Somerset. *Proc Univ. Bristol Spelaeological Soc* **7**, 130-136.

Alderton, A.M., 1983. The Sedgemoor survey 1982: environmental results. *Somerset Levels Papers* 9, 9-15.

Allen, J.R.L., 1986. A Short History of Salt Marsh Reclamation at Slimbridge Warth and Neighbouring Areas, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **104**, 139-155.

Allen, J.R.L., 1990a. Three Neolithic Axes from the Severn Estuary. *Transactions of the Bristol and Gloucestershire Archaeological Society* **108**, 171-174.

Allen, J.R.L., 1990b. Late Flandrian Shoreline Oscillations in the Severn Estuary: Change and Reclamation at Arlingham, Gloucestershire. *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences* **330**, 315-334.

Allen, J.R.L., 1991. Salt-marsh Accretion and Sea-level Movement in the Inner Severn Estuary, Southwest Britain: the archaeological and historical contribution. *Journal of the Geographical Society, London* **148**, 485-494.

Allen, J.R.L., 1992. A Reconnaissance Map of Medieval Alluvial Ploughlands in the Vale of Berkeley, Gloucestershire and Avon. *Transactions of the Bristol and Gloucestershire Archaeological Society* **110**, 87-97.

Allen, J.R.L., 1993. Muddy Alluvial Coasts of Britain: field criteria for shoreline position and movement in the recent past. *Proceedings of the Geologists' Association* **104**, 241-262.

Allen, J.R.L., 1996. A Possible Medieval Trade in Iron Ores in the Severn Estuary of South West Britain. *Medieval Archaeology* **40**, 226-230.

Allen, J.R.L., 1997a. Geological Impacts on Coastal Wetland Landscapes: Sea-level rise, with illustrations from the River Banwell. *Proceedings of the Somerset Archaeology and Natural History Society* **141**, 17-34.

Allen, J.R.L., 1997b. The Geoarchaeology of Land-Claim in Coastal Wetlands: a sketch from Britain and north-west European Atlantic-North Sea coasts. *The Archaeological Journal* **154**, 1-54.

Allen, J.R.L., 1997c. A Scatter of Neolithic-Bronze Age Flintwork from the Intertidal Zone at Hills Flats, South Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **CXV**, 265-76.

Allen, J.R.L., 1997d. Simulation model of salt-marsh morphodynamics: some implications for high-intertidal sediment couplets related to sea level change. *Sedimentary Geology*, **113**, 211-223.

Allen, J.R.L., 1998a. Romano-British and Early Medieval Pottery Scatters on the Alluvium at Hill and Oldbury, Severn Estuary Levels. *Archaeology in the Severn Estuary* **8**, 67-81.

Allen, J.R.L., 1998b. A Prehistoric (Neolithic-Bronze Age) Complex on the Severn Estuary Levels, Oldbury-on-Severn, South Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **116**, 93-115.

Allen, J.R.L., 2000. Two Probable Wooden Jetties at Cone Pill, Lydney Level, Gloucestershire. *Archaeology in the Severn Estuary* **10**, 132-134.

Allen, J.R.L., 2001a. Sea level, salt marsh and fen: shaping the Severn Estuary Levels in the Later Quaternary (Ipswichian-Holocene). *Estuarine Archaeology: the Severn and Beyond. Archaeology in the Severn Estuary* **11** (2000), 13-34.

Allen, J.R.L., 2001b. The Landscape Archaeology of Lydney Level, Gloucestershire: natural and human transformations over the last two millennia. *Transactions of the Bristol and Gloucestershire Archaeological Society* **119**, 27-57.

Allen, J.R.L., 2002. A Medieval waterside settlement overlooking Severn-Estuary alluvium, Hock Cliff, Fretherne and Saul, Gloucestershire. *Archaeology in the Severn Estuary* **12**, 79-98.

Allen, J.R.L., 2003a. Intertidal Archaeology at Old Passage, Aust, Gloucestershire: a sketch of the surviving evidence. *Archaeology in the Severn Estuary* **13**, 53-64.

Allen, J.R.L., 2003b. A Post-Roman Pottery Assemblage from Hills Flats, South Gloucestershire; Trade and Communication by Water in the Severn Estuary. *Transactions of the Bristol and Gloucestershire Archaeological Society* **121**, 201-212.

Allen, J.R.L., 2005. Fish traps in the Middle Severn Estuary: air photographic evidence from the mid twentieth-century. *Archaeology in the Severn Estuary* **15**, 31-48.

Allen, J.R.L., 2006. Teleconnections and their Archaeological Implications, Severn estuary Levels and the Wider region: the 'fourth' and other mid-Holocene peats. *Archaeology in the Severn Estuary* **16**, 17-65.

Allen, M.J., Crockett, A., Rawlings, M.N. & Ritchie, K., 1997. Archaeological Fieldwork Along the Line of the Brean Down Sea Defences; new evidence of landscape change and human activity. *Archaeology in the Severn Estuary* **7**, 31-38.

Allen, J.R.L. & Fulford, M.G., 1987. Romano-British Settlement and Industry on the Wetlands of the Severn Estuary. *Antiquaries Journal* **67**, 237-289.

Allen, J.R.L. & Fulford, M.G., 1990a. Romano-British Wetland Reclamations at Longney, Gloucestershire, And Evidence for The Early Settlement of The Inner Severn Estuary. *Antiquaries Journal* **70(2)**, 288-326.

Allen, J.R.L. & Fulford, M.G., 1990b. Romano-British and Later Reclamations on the Severn Salt Marshes in the Elmore Area, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **108**, 17-32.

Allen, J.R.L. & Fulford, M.G., 1992. Romano-British and Later Geoarchaeology at Oldbury Flats: Reclamation and Settlement on the Changeable Coast of the Severn Estuary. *Archaeological Journal* **149**, 82-123.

Allen, J.R.L. & Fulford, M.G., 1993. The Late Flandrian Tidal Palaeochannel at Hills Flats on the Avon-Gloucestershire Border. *Archaeology in the Severn Estuary* **4**, 37-40.

Allen, J.R.L., Godden, D., Matthews, C. & Powell, A.B., 2003. Mesolithic, Late Bronze Age and Medieval activity at Katherine Farm, Avonmouth, 1998. *Archaeology in the Severn Estuary* **13**, 89-105.

Allen J.R.L. & Rae J. E., 1987. Late Flandrian Shoreline Oscillations in the Severn Estuary: A Geomorphological and Stratigraphical Reconnaissance. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* **315**, 185-230.

Allen, J.R.L. & Rippon, S., 1995. The Historical Simplification of Coastal Flood Defences: Four Case Histories from the Severn Estuary Levels, SW Britain. *Transactions of the Bristol and Gloucestershire Archaeological Society* **CXIII**, 73-88.

Allen, J.R.L. & Rippon, S., 1997. A Romano-British Shaft of Dressed Stone and the Settlement at Oldbury-on-Severn, South Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **CXV**, 19-27.

Allen, M.J. & Ritchie, K., 2000. The Stratigraphy and Archaeology of Bronze Age and Romano-British Deposits Below the Beach Level at Brean Down, Somerset. *Proceedings of the University of Bristol Spelaeological Society* **22(1)**, 5-52.

Anderson, J.G.C., 1968. The concealed rock surface and overlying deposits of the Severn valley from Upton to Neat. *Proc. of the South Wales Institute of Engineers* **83**, 27-47.

Andrews, J. T., Bowen, D.Q. and Kidson, C., 1979. Amino acid ratios and the correlation of raised beach deposits in south-west England and Wales. *Nature,* **281**, 556-558.

Atkinson, T.C., Briffa, K.R. and Coope, G.R., 1987. Seasonal temperatures in Britain during the last 22,000 years, reconstructed using beetle remains. *Nature* **325**, 587-592.

Bannerman, N. & Jones, C., 1999. Fish Trap Types: a component of the maritime cultural landscape. *International Journal of Nautical Archaeology* **28**, 70-84.

Barnes, I., Adam, N.J., Bellamy, P., Butterworth, C., Coe, D., Graham, A.H. and Powell, A., 1993. Second Severn Crossing: English Approaches; an interim statement on the 1992/3 fieldwork. *Archaeology in the Severn Estuary* **4**, 5-30.

Beckett, S.C., 1978. The environmental setting of the Meare Heath Track. *Somerset Levels Papers* **4**, 42-6.

Beckinsale, R.P. & Richardson, L., 1964. Recent Findings on the Physical Development of the Lower Severn Valley *The Geographical Journal* **130**, 87-105.

Bedford, A., Jones, R.T., Lang B., Brooks, S. & Marshall, J.D., 2004. A Late-glacial chironomid record from Hawes Water, northwest England. *Journal of Quaternary Science* **19 (3)**, 281-290.

Bell, M., 1990. *Brean Down excavations 1983-87*. London, English Heritage Archaeological Report 15.

Bell, M., 2001. Environmental Archaeology in the Severn Estuary: Progress and Prospects. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 69-104.

Bell, M., Caseldine, A. & Neumann, H., 2000. *Prehistoric Intertidal Archaeology in the Welsh Severn Estuary*. CBA Research Report 120.

BGS 1983. *Lundy, Sheet 51°N-06°W, Sea bed sediments*. Keyworth, British Geological Society.

BGS 1986. Bristol Channel, *Sheet 51°N-04°W, Sea bed sediments*. Keyworth, British Geological Society.

Bowen, D.Q., Sykes, G.A., Reeves, A., Miller, G.H., Andrews, J.T., Brew, J.S. & Hare, P.E., 1985. Amino-acid chronology of raised beaches in southwest Britain. *Quaternary Science Reviews* **4**, 279-318.

Boyd Dawkins, W., 1870. On the Discovery of Flint and Chert Under a Submerged Forest in West Somerset. *The Journal of the Ethnological Society of London* **2(2)**, 141-146.

Bradley, A.G., 1920. *A Book of the Severn*. London: Methuen & Co.

Brett, J., 1997. Archaeology and the construction of the Royal Edward Dock, Avonmouth, 1902-1908. *Archaeology in the Severn Estuary* **7**, 117-120.

Briggs, D.J., Gilbertson, D.D. & Hawkins, A.B., 1991. The raised beach and sub-beach deposits at Swallow Cliff, Middle Hope. *Proceedings of the Bristol Naturalists Society* **51**, 63-71.

Brown, A., 2005. *Wetlands and Drylands in Prehistory. Mesolithic to Bronze Age Activity and Impact in the Severn Estuary, Southwest Britain.* Unpublished PhD Thesis, University of Reading.

Brown, A.D., Bell, M., Timpany, S. & Nayling, N., 2006. Mesolithic to Neolithic and Medieval Coastal Environmental Change: Intertidal Survey at Woolaston, Gloucestershire. *Archaeology in the Severn Estuary* **16**, 67-83.

Brown, A.G., 1987. Holocene Floodplain Sedimentation and Channel Response of the Lower River Severn, United Kingdom. *Zeitschrift fur Geomorphologie* **31(3)**, 293-310.

Brunning, R., 2001. Wood as an Archaeological Resource: the Severn Estuary evidence. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 175-186.

Brunning, R., forthcoming. A millennium of fishing structures in Bridgewater Bay. Somerset Heritage Service typescript draft report.

Brunning, R. & Farr-Cox, F., 2006. The River Siger Rediscovered: LIDAR Survey and Relict Landscape on the Somerset Claylands. *Archaeology in the Severn Estuary* **16**, 7-15.

Bulleid, A., 1933. Ancient trackways in Meare Heath, Somerset. *Proceedings of the Somersetshire Archaeology and Natural History Society* **79**, 19-29.

Bulleid, A. & Jackson, J.W., 1937. The Burtle sand beds of Somerset. *Proceedings of the Somersetshire Archaeology and Natural History Society* **83**, 171-195.

Bulleid, A. & Jackson, J.W.,. 1941. Further notes on the Burtle sand beds of Somerset. *Proceedings of the Somersetshire Archaeology and Natural History Society* **87**, 111-116.

Burrow, I.C.G., 1976. Brean Down Hillfort, 1974. *Proceedings of the University of Bristol Spelaeological Society* **14(2)**, 151-154.

Butler, S., 1987. Coastal Change Since 6000BP and the Presence of Man at Kenn Moor, Avon. *Proceedings of the Somerset Archaeology and Natural History Society* **131**, 1-11.

Campbell, S., Hunt, C.O., Scourse, J.D., Keen, D.H. & Croot, D.G., 1999. Southwest England in **D.Q. Bowen (ed.)** *A revised correlation of Quaternary deposits in the British Isles* Geological Society Special Report No. 23. London, The Geological Society, 66-78.

Canti, M., Heal, V., McDonnell, R., Straker, V. & Jennings, S., 1996. Archaeological and Palaeoenvironmental Evaluation of Porlock Bay and Marsh. *Archaeology in the Severn Estuary* **6**, 49-70.

Carr, A.P., 1971. Coastal Changes at Bridgwater Bay: 1956-64. *Proceedings of the Bristol Naturalists' Society* **XXXI**, 91-100.

Carter, S., Jones, J. & Mc Gill, B., 2004. Pucklechurch to Seabank Pipeline: sediment stratigraphic and palaeoenvironmental data from the Avonmouth Levels. *Archaeology in the Severn Estuary* **14**, 69-86.

Cole, S.D., 1912. *The Sea Walls of the Severn*. Privately published.

Coles, J., 2001. Celebration and Reflection: The Severn Estuary Levels After Ten Years. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 209-211.

Coles, J.M., Coles, B.J., Morgan, R.A. & Caseldine, A.E., 1988. The Meare Heath track 1985. *Somerset Levels Papers* **14**, 6-33.

Coles, J.M. & Dobson, M.J., 1989. Calibration of radiocarbon dates from the Somerset Levels. Somerset Levels Papers, **15**, 64-69.

Coles, J.M. & Orme, B.J., 1976. The Meare Heath Trackway: excavation of a Bronze Age structure in the Somerset Levels. *Proceedings of the Prehistoric Society* **42**, 293-318.

Coles, J.M. & Orme, B.J., 1978a. The Meare Heath Track. *Somerset Levels Papers* **4**, 11-39.

Coles, J.M. & Orme, B.J., 1978b. Multiple trackways from Tinney's Ground. *Somerset Levels Papers* **4**, 48-81.

Coles, J.M. & Orme, B.J., 1980. Tinney's Ground, 1978-1979. *Somerset Levels Papers* ***6,*** 61-68.

Coope, G.R. & Lemdahl, G., 1995. Regional differences in the late glacial climate of northern Europe based on Coleopteran analysis. *Journal of Quaternary Science* **10**, 391-395.

Cuffey, K.M. & Marshall, S.J., 2000. Substantial contribution to sea-level rise during the last interglacial from the Greenland ice sheet. *Nature* **404**, 591-594.

Dennison, E. & Russett, V., 1989. Duck Decoys. Their function and management with reference to Nyland decoy, Cheddar. *Proceedings of the Somerset Archaeology and Natural History Society* **133**, 141-155.

Dickson, A. & Crowther, S., 2007. Rapid Coastal Zone Assessment for The Severn Estuary. Archaeological Aerial Survey. National Mapping Programme Interim Report. English Heritage and Gloucestershire County Council.

Druce, D., 1998. Palaeoenvironmental Constraints on Mesolithic to Romano-British Communities of the Severn-Estuary. *Archaeology in the Severn Estuary* **8**, 99-102.

Druce, D., 1999. Late Mesolithic and Early Neolithic Environmental Change in the Central Somerset Levels: Recent Work at Burnham-on-Sea. *Archaeology in the Severn Estuary* **9**, 17-30.

Druce, D., 2001. *Mesolithic to Romano-British Archaeology and Environmental Change of the Severn Estuary, England.* Unpublished PhD thesis, University of Bristol.

Druce, D., 2005. Holocene Relative Sea Level Change in the Severn Estuary: Regional and National Perspectives in **Smith, D.N, Brickley, M.B & Smith, W (eds)** *Fertile Ground: Papers in Honour of Susan Limbrey.* Oxford: Oxbow Books.

Dunning, R.W. & Elrington C.R. (eds), 1992. *A History of the County of Somerset: Volume 6.* Oxford University Press.

Edwards, H., 1998. *The charters of the Early West Saxon Kingdom*. Oxford. BAR British Series **198**.

Elrington, C.R. & Herbert, N.M., 1972. *A History of the County of Gloucester Volume X. Upper Severnside and Tidenham.* Oxford University Press.

Evans, D.J. & Thompson, M.S., 1979. The geology of the central Bristol Channel and the Lundy area, South Western Approaches, British Isles. *Proceedings of the Geologists' Association* **90**, 1-14.

Everton, A. & Everton, R., 1980. Romano-British Occupation at Crook's Marsh Farm, Avonmouth. *Bristol Archaeological Research Group Review* **2**, 57-8.

Farr, G., 1954. *Somerset Harbours*. Christopher Johnson.

Fulford, M. & Allen, J.R.L., 1992. Iron-Making at the Chesters Villa, Woolaston, Gloucestershire: Survey and Excavation 1987-91. *Britannia* **23**, 159-215.

Fulford, M.G., Rippon, S., Allen, J.R.L. & Hillam, J., 1992. The Medieval Quay at Woolaston Grange, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* **110**, 101-127.

Fulford, M., Champion, T. & Long, A. (eds), 1997. *England's Coastal Heritage. A Survey for English Heritage and the RCHME.* English Heritage Archaeological Report No.15.

Gardiner, J., Allen, M.J., Hamilton-Dyer, S., Laidlaw, S. & Scaife, R., 2002. Making the Most of it: Late Prehistoric Pastoralism in the Avon Levels, Severn Estuary. *Proceedings of the Prehistoric Society* **68**, 1-39.

Gardner, K. & Rippon, S., 1998. A Possible 12th Century Mill at Kingston Seymour, North Somerset. *Archaeology in the Severn Estuary* **8**, 102.

Garrett, C. Scott, 1938. Chesters Roman villa, Woolaston, Gloucestershire. *Archaeologia Cambrensis* **93**, 93-125.

Geraint Jenkins, J., 1974. *Nets and Coracles*. London: David & Charles.

Gilbert, P., 1997. The Pre-Conquest Landscape at Kingston Seymour on the North Somerset Levels: report on Fieldwork 1996. *Archaeology in the Severn Estuary* **7**, 53-59.

Gilbertson, D.D. & Hawkins, A.B., 1977. The Quaternary deposits at Swallow Cliff, Middlehope, County of Avon. *Proceedings of the Geologists Association*, **88(4)**, 225-226.

Gilbertson, D.D. & Hawkins, A.B., 1978. *The Pleistocene Succession at Kenn, Somerset*. Bulletin of the Geological Survey of Great Britain, **66**. London, HMSO.

Gilbertson, D.D, Hawkins, A.B, Mills, C.M, Harkness, D.D & Hunt, C.O., 1990. The Late Devensian and Holocene of Industrial Severnside and the Vale of Gordano: stratigraphy, radiocarbon dating and palaeoecology *Proceedings of the Ussher Society* **7 (3)**, 281-286.

Girling, M.A., 1978. Observations on the Tinney's insect assemblages. *Somerset Levels Papers* 4, 55-56.

Godbold, S. & Turner, R.C., 1994. Medieval fish traps in the Severn Estuary *Medieval Archaeology* 38, 19-54.

Godwin, H., 1955. Studies of the post-glacial history of British vegetation XIII. The Meare Pool region of the Somerset Levels. *Philosophical Transactions of the Royal Society* **B239**, 161-190.

Godwin, H. 1960. Prehistoric wooden trackways of the Somerset Levels: their construction, age and relation to climate change. *Proceedings of the Prehistoric Society* **26**, 1-36.

Godwin, H., 1967. Discoveries in the peat near Shapwick Station, Somerset. *Proceedings of the Somersetshire Archaeology and Natural History Society* **111**, 20-23.

Green, C., 1997. The Forest Ports of the Severn Estuary. *Archaeology in the Severn Estuary* **7**, 107-116.

Green, C., 1999. *Severn Traders.* Bristol: APB Process Print.

Green, M., 1993. A Carved Stone Head from Steep Holm. *Britannia* **24**, 241-2.

Green, S., 1996. Trows and the Severn Coastal Trade. *Archaeology in the Severn Estuary* **6**, 97-114.

Grinsell, L.V., 1971. Somerset Barrows. Part II: North and East. *Proceedings of the Somersetshire Archaeological and Natural History Society* **115**, 43-137.

Grove. J., 2003. Reclamation and utilisation of the upper Axe valley during the Roman period. *Archaeology in the Severn Estuary* **13**, SELRC. Exeter.

Groves, C., Locatelli, C. & Nayling, N., 2004. Tree-Ring Analysis of Oak Samples from Stert Flats Fish Weirs, Bridgwater Bay, Somerset, *Centre for Archaeology Report 43/2004*. English Heritage.

Haslett, S.K., Davies, P., Curr, R.H.F., Davies, C.F.C., Kennington, K., King, C.P. & Margetts, A.J., 1998a. Evaluating late-Holocene relative sea-level change in the Somerset Levels, southwest Britain. *The Holocene* **8(2)**, 197-207.

Haslett, S., Davies, P. & Strawbridge, F., 1998b. Reconstructing Holocene Sea-Level Change in the Severn Estuary and Somerset Levels: the foraminifera connection. *Archaeology in the Severn Estuary* **8**, 29-40.

Haslett, S.K., Margretts, A.J. & Williams, H., 2000. Foraminifera. In **S. Rippon** The Romano-British exploitation of coastal wetlands: survey and excavation on the North Somerset Levels, 1993-7, 118-122. *Britannia*, **31**, 69-200.

Haslett, S.K., Davies, P., Davies, C.F.C., Margetts, A.J., Scotney, K.H., Thorpe, D.J. & Williams, H.O., 2001a. The Changing Estuarine Environment in Relation to Holocene Sea-Level and the Archaeological Implications. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 35-54.

Haslett, S.K., Howard, K.L., Margetts, A.J. & Davies, P., 2001b. Holocene stratigraphy and evolution of the northern coastal plain of the Somerset Levels, UK. *Proceedings of the Cotteswold Naturalists' Field Club* **42**, 1, 78-88.

Hawkins, A.B., 1962. The buried channel of the Bristol Avon. *Geological Magazine* **99**, 369-374.

Hawkins, A.B., 1990. Geology of the Avon Coast. *Proc. Bristol Naturalists' Society*, **50**, 3-27.

Hewlett, R., 1997. *Holocene Environmental Change and the Response to Sea-Level in the Inner Severn Estuary.* Unpublished PhD thesis, University of Bristol.

Hewlett, R. & Birnie, J., 1996. Holocene Environmental Change in the Inner Severn estuary, UK: an example of the response of estuarine sedimentation to relative sea-level change. *The Holocene* **6 (1)**, 49-61.

Herbert, N.M., 1996. *A History of the County of Gloucester Volume V The Forest of Dean*. Oxford University Press.

Heyworth, A. & Kidson, C., 1982. Sea Level Changes in South West England and in Wales. *Proceedings of the Geologists Association* **93(1)**, 91-111.

Hilditch, M., 1998. Preliminary Survey of Coastal Archaeology including the Intertidal Zone between Wains Hill (Clevedon) and Sand Point (Worle), North Somerset. *Archaeology in the Severn Estuary* **8**, 99-101.

Hill, T., Woodland, W., Spencer, C., Case, D., Marriot, S., Bridle, A. & Brown, H., 2006. Late Quaternary Environmental Change in the Gordano valley. In **C.O. Hunt and S.K. Haslett (eds.)** *Quaternary of Somerset Field Guide*, 115-143. Edinburgh, Quaternary Research Association.

Holbrook, N., 2006. The Roman Period in **Holbrook, N & Jurica, J** *Twenty-Five Years of Archaeology in Gloucestershire. A Review of New Discoveries and New Thinking in Gloucestershire, South Gloucestershire and Bristol 1979-2004.* Cotswold Archaeology, 97-131.

Hollinrake, C. & Hollinrake, N., 2002. Walpole landfill site, Somerset. *Archaeology in the Severn Estuary* **12**, 119-125.

Horner, W., 1996. *Excavation of Late Bronze Age trackways at Skinner's Wood, Somerset.* Unpubl. MSS.

Housley, R.A., Straker, V. and Cope, D.W., 2000. The Holocene peat and alluvial stratigraphy of the Upper Brue valley in the Somerset Levels based on Soil Survey data of the 1980's. *Archaeology in the Severn Estuary* **10**, 11-23.

Hume, L., 1992. *Oldbury-on-Severn Silt Lagoon*. Unpublished report for the Avon Archaeological Unit.

Hunt, C.O., 2006. The Burtle Formation. In C.O. Hunt and S.K. Haslett (eds.) *Quaternary of Somerset Field Guide*, 173-186. Edinburgh, Quaternary Research Association.

Hunt, C.O. & Bowen, D.Q., 2006. Devensian Interstadial marginal-marine deposits at Low Ham. In C.O. Hunt and S.K. Haslett (eds.) *Quaternary of Somerset Field Guide*. Edinburgh, Quaternary Research Association, 196-204

Hunt, C.O. & Clark, G., 1983. The palaeontology of the Burtle Beds at Middlezoy, Somerset. *Proceedings of the Somersetshire Archaeology and Natural History Society* **127**, 129-130.

Insole, P., 1997. An Investigation of a Medieval and Post-Medieval Field Boundary Complex at British Gas Seabank, on the North Avon Levels. *Archaeology in the Severn Estuary* **7**, 95-106.

Jefferies, R.L., Wilis, A.J. & Yemm, E.W., 1968. The Late post-Glacial History of the Gordano Valley, North Somerset. *New Phytologist* **67**, 335-348.

Jennings, S., Orford, J.D., Canti, M., Devoy R.J.N. & Straker, V., 1998. The role of relative sea-level rise and changing sediment supply on Holocene gravel barrier development: the example of Porlock, Somerset, UK. *The Holocene* **8(2)**, 165-181.

Jones, J., 2003. *Plant macrofossil remains from the Huntspill saltern*. Unpublished report for Somerset County Council.

Jones, J., Tinsley, H., Mc Donnell, R., Cameron, N., Haslett, S. & Smith, D., 2005. Mid Holocene Coastal Environments from Minehead Beach, Somerset, UK. *Archaeology in the Severn Estuary* **15**, 49-69.

Ketling, E.L., 1968. The Rivers and Sea Walls of Somerset. *Proceedings of the Somerset Archaeology and Natural History Society* **112**, 12-20.

Kidson, C., 1970. The Burtle beds of Somerset. *Proceedings of the Ussher Society*, **2**, 189-191.

Kidson, C., Gilbertson, D.D., Haynes, J.R., Heyworth, A., Hughes, C.E. & Whatley, R.C., 1978. Interglacial marine deposits in the Somerset Levels. *Boreas*, **7**, 215-228.

Kidson, C. & Heyworth, A. 1973. The Flandrian Sea Level Rise in the Bristol Channel. *Proceedings of the Ussher Society* **2**, 565-584.

Kidson, C. & Heyworth, A., 1976. The Quaternary Deposits of the Somerset Levels. *Quaternary Journal of Engineering Geology* **9**, 217-235.

King, C. & Haslett, S., 1999. Modern Saltmarsh Foraminifera Distribution in Stert Flats, Bridgwater Bay, UK: Preliminary Results. *Archaeology in the Severn Estuary* **9**, 90-92.

Knight, D. and Howard, A.J., 2004. *Trent Valley Landscapes, The Archaeology of 500,000 years of change*. Heritage Marketing and Publications. King's Lynn.

Lawler, M., Parkhouse, J. and Straker, V., 1992 . Archaeology of the Second Severn Crossing: Assessment and Recommendations for the English Approaches. GGAT Report.

Leech, R.H., 1997. Late Iron Age and Romano-British Briquetage Sites at Quarrylands Lane, Badgworth. *Proceedings of the Somerset Archaeological and Natural History Society*, **121**, 89-96.

Leese, C.E. and Vernon, W.F., 1960. Basal gravel in the alluvium near Severn Beach. *Proceedings of the Bristol Naturalists' Society* **30**, 139-142.

Locock, M., 1998. Rockingham Farm, Avonmouth, 1993-1997: moated enclosures on the North Avon Levels. *Archaeology in the Severn Estuary* **8**, 83-88.

Locock, M., 2000a. Cabot Park, Avonmouth, Bristol: excavations on Later Bronze Age and Medieval Sites at Kites Corner and Moorend Farm, 1999. *Archaeology in the Severn Estuary* **10**, 125-128.

Locock, M., 2000b. Buried Soils of the Wentloodge Formation. *Archaeology in the Severn Estuary* **10**, 1-10.

Locock, M., 2001a. Archaeological Prospection and Evaluation in the Severn Levels, 1989-1999. Developing a Methodology. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 131-144.

Locock, M., 2001b. A Later Bronze Age Landscape on the Avon Levels: settlement, shelters and saltmarsh at Cabot Park in **Bruck, J (ed)** *Bronze Age Landscapes: Tradition and Transformation*. Oxford: Oxbow, 121-128.

Locock, M. & Lawler, M., 1996. Brean Down Sea Defences: field evaluation. *Archaeology in the Severn Estuary* **6**, 23-28.

Locock, M., Robinson, S. & Yates, A., 1999. Late Bronze Age Sites at Cabot Park, Avonmouth. *Archaeology in the Severn Estuary* **9**, 31-36.

Long, A.J., Dix, J.K., Kirby, R., Lloyd Jones, D., Roberts, D.H., Croudace, I.W., Cundy, A.B., Roberts, A. & Shennan, I., 2001. *The Holocene and recent evolution of Bridgwater Bay and the Somerset Levels.* University of Durham, Durham.

Lucy, W.C., 1877. The submerged forest, Holly Hazle, Sharpness. *Proceedings of the Cotteswold Naturalists' Field Club* **6**, 105-125.

McDonnell, R., 1980. Tidal fish weirs in West Somerset in Burrow I *et al.* (ed) Somerset Archaeology 1979. *Proceedings of the Somerset Archaeology and Natural History Society*, **124**,134-5.

McDonnell, R., 1984. Duck Decoys in Somerset, a gazetteer. *Proceedings of the Somerset Archaeology and Natural History Society* **128**, 25-30.

McDonnell, R., 1993. Preliminary Archaeological Assessment of Bridgwater Bay: Gore Sands and Stert Flats. *Archaeology in the Severn Estuary* **4**, 41-46.

McDonnell, R., 1995a. Bridgwater Bay: a summary of its geomorphology, tidal characteristics and intertidal cultural resource. *Archaeology in the Severn Estuary* **5**, 87-114.

McDonnell, R., 1995b. *Porlock Bay and Marsh: a rapid preliminary assessment of the cultural and palaeoenvironmental resource.* Typescript report for Exmoor National Park Authority.

McDonnell, R., 1996. Island Evolution in Bridgwater Bay and the Parrett Estuary: an historical geography. *Archaeology in the Severn Estuary* **6**, 71-84.

McDonnell, R., 1998. *Porlock Bay: Aurochs excavation report*. Typescript report for Exmoor National Park Authority.

McDonnell, R., 2002a. *Porlock Bay and Marsh : record of archaeological monitoring 1998-2002.* Typescript report for Exmoor National Park Authority.

McDonnell, R., 2002b. *Archaeological sampling of two intertidal palaeochannels in Porlock Bay. Interim report.* Typescript report for Exmoor National Park Authority.

McDonnell, R., 2003a. Saxon Timber from Porlock Marsh. *Proceedings of the Somerset Archaeology and Natural History Society* **147**, 183-185.

McDonnell, R., 2003b. *Porlock Bay and Marsh: record of archaeological monitoring 2002-3.* Typescript report for Exmoor National Park Authority.

McDonnell, R., 2004. *Porlock Bay and Marsh: record of archaeological monitoring 2003-4.* Typescript report for Exmoor National Park Authority.

McDonnell, R., 2005 . *Porlock Bay and Marsh: Archaeological Monitoring 2004-5 annual report*. Typescript report for Exmoor National Park Authority.

McDonnell, R. & Straker, V., 1989. *Severn Tidal Barrage Phase I Survey (England): Known Archaeological and Palaeoenvironmental Sites in the Intertidal Zone*. Gloucestershire and Somerset County Council Planning Departments unpublished typescript.

Magny, M., 2004. The contribution of palaeoclimatology to the lake-dwellings. In **F. Menotti, (ed.)** *Living on the Lake in Prehistoric Europe*, 132-143. Routledge. London.

Masser, P., Jones, J. & McGill, B., 2005. Romano-British Settlement and Land Use on the Avonmouth Levels: the evidence of the Pucklechurch to Seabank pipeline project. *Transactions of the Bristol and Gloucestershire Archaeological Society* **123**, 55-86.

Moore, C., Allen, M.J. & Scaife, R., 2003. An Archaeological Evaluation at Western Business Park, Severnside, South Gloucestershire. *Archaeology in the Severn Estuary* **13**, 159-162.

Mullin, D., 2005. Rapid Coastal Zone Assessment for the Severn Estuary. Project Design. November 2005. PNUM 3885PD. Typescript report.

Murphy, P., 2005 *A Brief for English Heritage Rapid Coastal Zone Assessment Surveys,* English Heritage. Version 7

Parker, A.J., 1999. Remains of Boats at Purton (East), Gloucestershire. *Archaeology in the Severn Estuary* **9**, 91-93.

Parkhouse, N., 2001. *A Glance Back at Lydney Docks.* Lydney: Black Dwarf.

Peel, J.H.B., 1968. *Portrait of the Severn*. London: Robert Hale.

Posford Duvier, 2000. Bristol Channel Marine Aggregates: Resources and Constraints Research project Final report (2 volumes). Posford Duvier Environment typescript report.

Prevost, E.W., Reade, T.M., Kennard, A.S. & Woodward, B.B., 1901. The peat and forest bed at Westbury-on-Severn. Proceedings *of the Cotteswold Naturalists' Field Club* **9**, 17-46.

Price, E & Spry, N., 2004. Notes on a Timber Trackway Close to the River Severn at Hinton. *Glevensis* **37**, 42.

Putley, J., 1999a. *Riverine Dean. The Maritime and Waterfront Archaeology of the Forest of Dean.* Dean Archaeological Group Occasional Publication No. 5.

Putley, J., 1999b. The Quay at Newnham. *Dean Archaeology* **12**, 25.

Reade, R.C., 1885. The Roman villa at Great Wemberham. *Proceedings of the Somerset Archaeological and Natural History Society*, **31(ii),** 64-73.

Rendell, J. & Rendell, S., 1993a. Steep Holm – a brief summary of archaeological research. *Archaeology in the Severn Estuary* **4**, 47-54.

Rendell, J. & Rendell, S., 1993b. *Steep Holm: The Story of a Small Island.* Alan Sutton.

Rhodes, E., 2003. *OSL Dating Report P107*. Oxford. University of Oxford.

Richardson, L., 1964. *The River Severn Between Upper Arley and Gloucester*.

Riley, H., 1996. Brean Down, Somerset: interim report on a new survey by the Royal Commission on the Historical Monuments of England. *Archaeology in the Severn Estuary* **6**, 13-22.

Riley, H., 1999. Intertidal Survey at Avonmouth and Oldbury-on-Severn. *Archaeology in the Severn Estuary* **9**, 79-80.

Rippon, S., 1994. The Severn Wetlands During the Historic Period. *Archaeology in the Severn Estuary* ***4***, 31-36.

Rippon, S., 1995a: Roman Settlement and Salt Production on the Somerset Coast: The Work of Sam Nash. *Proceedings of the Somerset Archaeological and Natural History Society.* **139**; pp. 99-117

Rippon, S., 1995b. The Roman Settlement and Landscape at Kenn Moor, North Somerset: interim report on survey and excavation, 1993/4. *Archaeology in the Severn Estuary* **5**, 21-34.

Rippon, S., 1996. The Roman Settlement and Landscape at Kenn Moor, Avon: second interim report on survey and excavation, 1994/5. *Archaeology in the Severn Estuary* **6**, 35-48.

Rippon, S.,1997a. *The Severn Estuary. Landscape Evolution and Wetland Reclamation.* Leicester University Press.

Rippon, S., 1997b. Roman and Medieval Settlement on the North Somerset Levels: survey and excavation at Banwell and Puxton, 1996. *Archaeology in the Severn Estuary* **7**, 39-52.

Rippon, S., 1998. Roman and Medieval Settlement on the North Somerset Levels: the second season of survey and excavation at Banwell and Puxton, 1997. *Archaeology in the Severn Estuary* **8**, 41-54.

Rippon, S., 1999. Medieval Settlement on the North Somerset Levels: the third season of survey and excavation at Puxton, 1998. *Archaeology in the Severn Estuary* **9**, 69-78.

Rippon, S., 2000. Medieval Settlement on the North Somerset Levels: the fourth season of survey and excavation at Puxton, 1999. *Archaeology in the Severn Estuary* **10**, 65-73.

Rippon, S., 2001a. *The Transformation of Coastal Wetlands. Exploitation and Management of Marshland Landscapes in North west Europe during the Roman and Medieval Periods.* Oxford University Press.

Rippon, S., 2001b. The Historic Landscapes of the Severn Estuary Levels. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 145-162.

Rippon, S., 2004. Taming a Wetland Wilderness: Romano-British and Medieval Reclamation in the Somerset Levels and Moors. *Proceedings of the Somerset Archaeology and Natural History Society* **148**, 157-164.

Rippon, S., 2007. *Landscape, Community and Colonisation: the North Somerset Levels during the 1st to 2nd millennia AD*. CBA Research Report **152**.

Rowbotham, F.W., 1978. The River Severn at Gloucester with Particular Reference to its Roman and Medieval Channels. GLEVENSIS **12**, 4-9.

Rowbotham, F.W., 1993. The Fish Weirs of the River Severn. *Glevensis* **27**, 4-7.

Sawyer, P.H., 1968. *Anglo-Saxon Charters*. Royal Historical Society. London.

Seddon, B., 1964. Submerged Peat Layers in the Severn Channel near Avonmouth *Proceedings of the Bristol Naturalists Society* **31**, 101-6.

Siegbert, O., 1996. *The Erosion of Saltmarshes along the Severn Estuary, SW Britain.* Unpublished PhD Thesis, University of Reading.

SELRC 1988. Severn Estuary Levels Research Committee. The archaeological potential of the Severn Estuary: an initial assessment for STPG. typescript report 2 volumes.

Shennan, I., Lambeck, K., Flather, R., Horton, B., McArthur, J., Innes, J.B., Lloyd, J.M., Rutherford, M. & Wingfield, R., 2000. Modelling western North Sea palaeogeographies and tidal changes during the Holocene. *Geological Society, London. Special Publication* **166***,* 299-319.

Smith, D., 2003. *The Insect remains from the Huntspill saltern*. University of Birmingham Environmental Archaeology Services Report Number **47**.

Solley, T.W.J., 1966. Roman Remains from the Severn Bridge Approach at Aust. *Transactions of the Bristol and Gloucestershire Archaeological Society* **85**, 36-44

Straker, V., McDonnell, R, Tinsley, H , Camerson, N. & Kreiser, A. 2004. 'Once more unto the breach': post glacial landscape change and human activity in Porlock Bay and Marsh. In **Wilson-North R (ed)** *Exmoor's Historic Coast.* Exmoor National Park Authority.

Straker, V., Brown, A., Fyfe, R., Jones, J. & Wilkinson, K., 2008. Later Bronze Age and Iron Age Environmental Background in **Webster 2008**, 103-116.

Sykes, C.M., 1938. Some Flint Implements from the Blackstone Rocks, Clevedon. *Proceedings of the University of Bristol Speleological Society* **5(1),** 75-79.

Sylvester, A.V., 2005. Settlement and Structures of the Severn Estuary Region as Evidence of wetland-dryland interaction in the Iron Age. *Archaeology in the Severn Estuary* **15**, 9-30.

Taylor, H. & Taylor, E.E., 1949. An early beaker burial? at Brean Down near Weston-Super-Mare. *Proceedings of the University of Bristol Speleological Society* **6,** 88-93

Timpany, S., 2005. *A Palaeoecological Study of the Submerged Forests in the Severn Estuary and Bristol Channel, UK.* Unpublished PhD Thesis, University of Reading.

Tinsley, H., 2003. *Pollen analysis of samples from peat and alluvium associated with a saltern near Woolavington Bridge, Huntspill River, Somerset*. Unpublished report for Somerset County Council.

Tooley, M.J. and Shennan, I., (eds) 1987. *Sea level changes*. Oxford. Blackwell.

Townley, E., 1999. Fieldwork on the Forest Shore: Stroat to Woolaston, Gloucestershire. *Archaeology in the Severn Estuary* **9**, 80-83.

Trow S. & Murphy, P., 1999 A Brief for Rapid Coastal Zone Assessment Surveys English Heritage and RCHME, English Heritage. Release 2.

Truscoe, K., 2007 Rapid Coastal Assessment for the Severn Estuary. Assessment of Environment Agency Lidar data. Trial Areas: Somerset and Gloucestershire. English Heritage and Somerset County Council.

Turner, R., Allen, J.R.L. & Rippon, S., 2001. The Severn Estuary levels: Ten Years Past and Ten Years Forward. *Estuarine Archaeology. The Severn and Beyond. Archaeology in the Severn Estuary* **11**, 1-12.

Tyers, I., 2004. *Tree-ring analysis of archaeological timbers from the Testwood III site, Netley Marsh, Hampshire*. ARCUS Project Report 573G. University of Sheffield.

Vickery, E., 1999. *A Late Holocene Palaeoenvironmental Reconstruction at Withey Bridge Farm, Somerset Levels*. Unpublished report in Somerset HER 12212.

Walker, K., 2003. Time and Tide at Portlands Nab. *The New Regard* **18**, 29-32.

Waters, B., 1947. *Severn Tide*. London: JM Dent.

Webster C.J., (ed.), 2008. *The Archaeology of South West England*. South West Archaeological Research Framework, Resource Assessment and Research Agenda. Somerset County Council.

Whittaker, A. and Green, G.W., 1983. *Geology of the country around Weston-super-Mare*. Memoir of the Geological Survey of Great Britain. London, HMSO.

Whittle, A.W.R, & Green, H.S., 1988. *The Archaeological Potential of the Severn Estuary: an initial assessment for STPG (Two Volumes).* Severn Estuary Levels Research Committee unpublished typescript.

Wilkinson, K., 1999. An investigation of Holocene peat and intertidal stratigraphy on Shapwick Heath, Somerset: Preliminary results. *Archaeology in the Severn Estuary* **9**, 87-90.

Wilkinson, K., 2006. *River Parrett bank strengthening, Somerset: borehole survey. Final report.* Winchester, ARCA Report 0607-8.

Wilkinson, K., 2007. *River Parrett bank strengthening at Moorland House and Thatcher's Arms, Somerset: geoarchaeological borehole survey. Project 108808/9-25.* Winchester, ARCA Report 0708-1.

Wilkinson, K. & Straker, V., 2008. Neolithic and Bronze Age Environmental Background in **Webster 2008**, 63-74.

Woods, M.K., 1962. *Newnham on Severn: a retrospective*. Gloucester: Smith.

Wright, N., 2004. *Purton Foreshore Structures, Hinton, Gloucestershire*. GCCAS Unpublished report held by Gloucestershire SMR 22483.

Young, A., forthcoming. Wessex Water Oldbury-on-Severn Discharge Pipeline, Aust South Gloucestershire. Archaeological, Geoarchaeological and Paleaoenvironmental Investigations 2003-4. Archaeology in the Severn Estuary.

18 Acknowledgements

Most Phase 1 RCZA tasks, including the production of the first draft of this report were undertaken by David Mullin at Gloucestershire County Council except as follows. Toby Catchpole (GCC) acted as project manager updated this draft. Coastal change was assessed and borehole information provided by Richard Brunning at Somerset County Council (SCC). National Mapping Programme tasks were undertaken by Steve Crowther and Amanda Dixon (GCC) based at the English Heritage NMR in Swindon. Training and day to day management of NMP staff was undertaken by Helen Winton (EH). The assessment of Lidar data was undertaken by Krystyna Truscoe (SCC) based at the NMR, advised by Richard Brunning. Figures were produced by David Mullin and Toby Catchpole except for those associated with chapter 10 (Figures 24-26) drafted by Richard Brunning.

The English Heritage Project Officer was Buzz Busby. Advice and direction was also received from Peter Murphy (EH), Vanessa Straker (EH), Rob Iles (EH), Jan Wills (GCC), David Haigh (South Gloucestershire), Bob Jones (Bristol) and Bob Croft (Somerset).

SMR/HER data and advice was provided by Tim Grubb (GCC), David Evans (Sth Glos), Bob Jones (Bristol), Vince Russett and Stuart Cakebread (Nth Somerset) and Chris Webster (Somerset). Thanks also go to Andrew Young at Avon Archaeology for providing information regarding recent work at Cowhill and Aust and not so recent work at Oldbury and to Richard Brunning for providing a draft version of his forthcoming report into fishing structures in Bridgewater Bay.

19 Abbreviations

CHAMP	Coastal Habitat Management Plan
DEFRA	Department for Environment, Food and Rural Affairs
EH	English Heritage
GCC	Gloucestershire County Council
HER	Historic Environment Record
NMP	National Mapping Programme
NMR	National Monuments Record
OD	(Above) Ordnance Datum
OIS	Oxygen Isotope Stage
RCZA	Rapid Coastal Zone Assessment
SCC	Somerset County Council
SMP	Shoreline Management Plan
SMR	Sites and Monuments Record
UKHO	United Kingdom Hydrographic Office

Figure 1: Severn Estuary RCZA - Extent of coastline

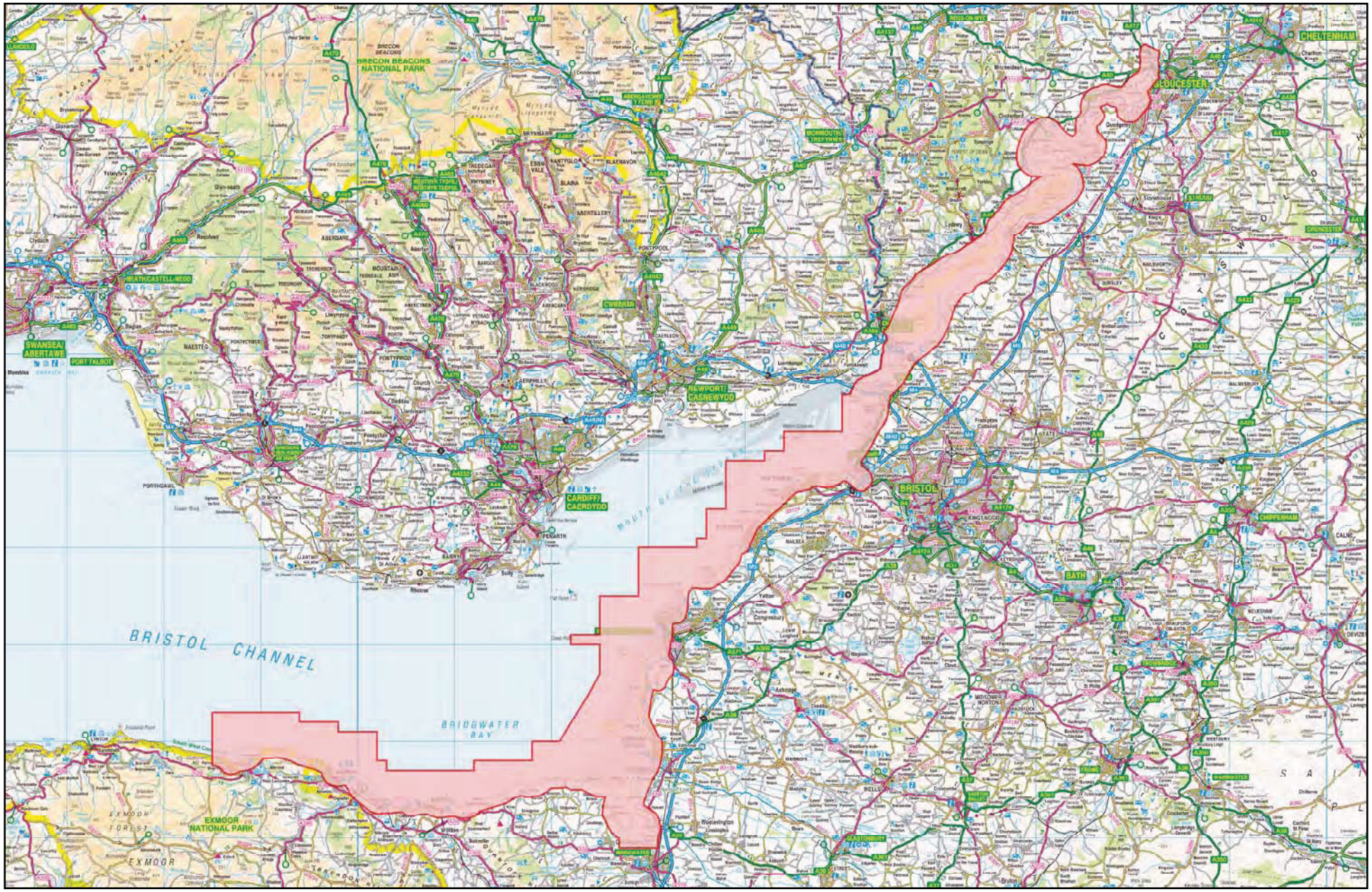

Figure 2: Severn Estuary RCZA Survey Area

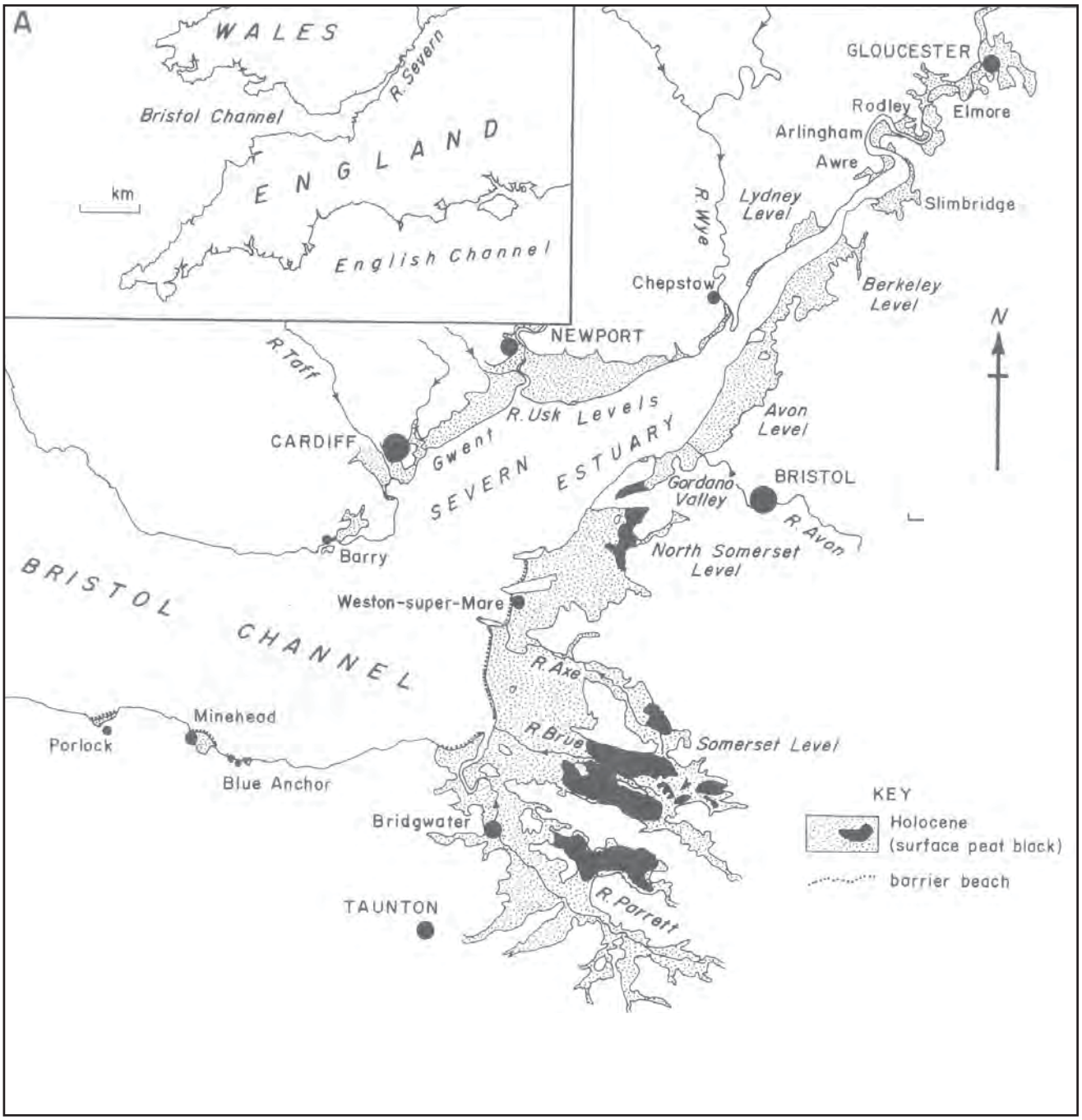

Figure 3: Sediments within the RCZA survey area (taken from Allen 2001a)

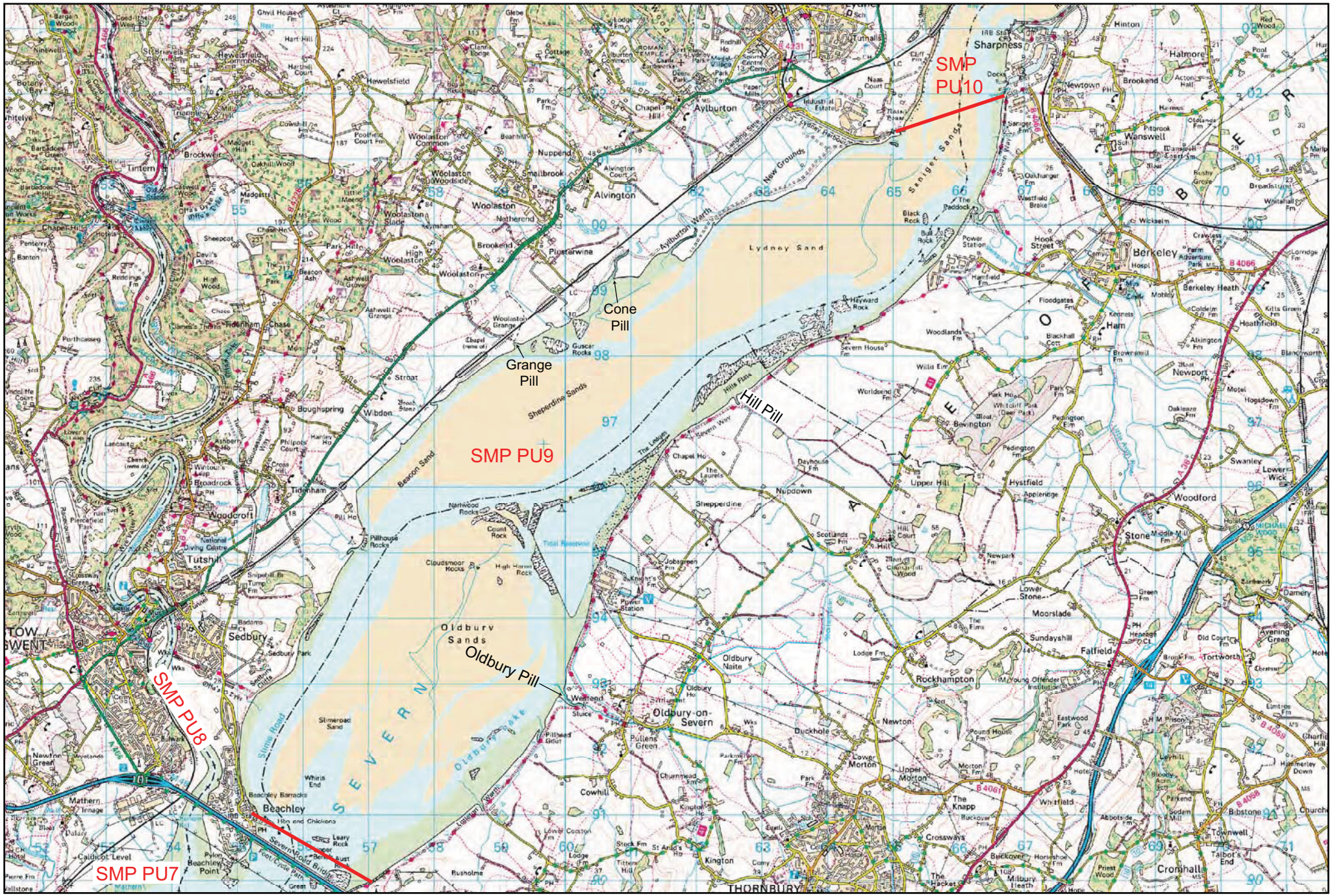

Figure 4: Beachley to Lydney and Sharpness to Severn Bridge

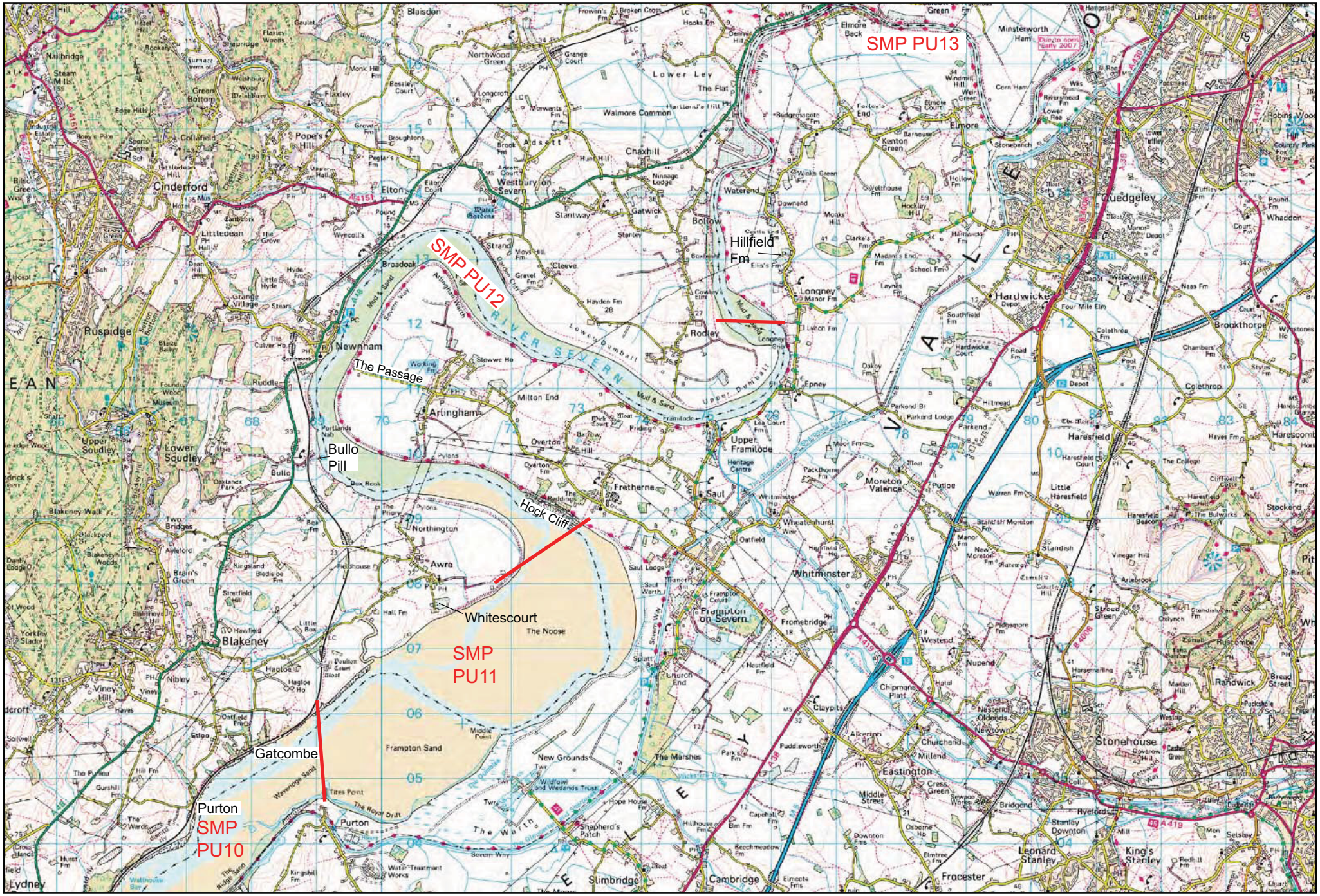

Figure 5: Lydney to Gloucester and Gloucester to Purton

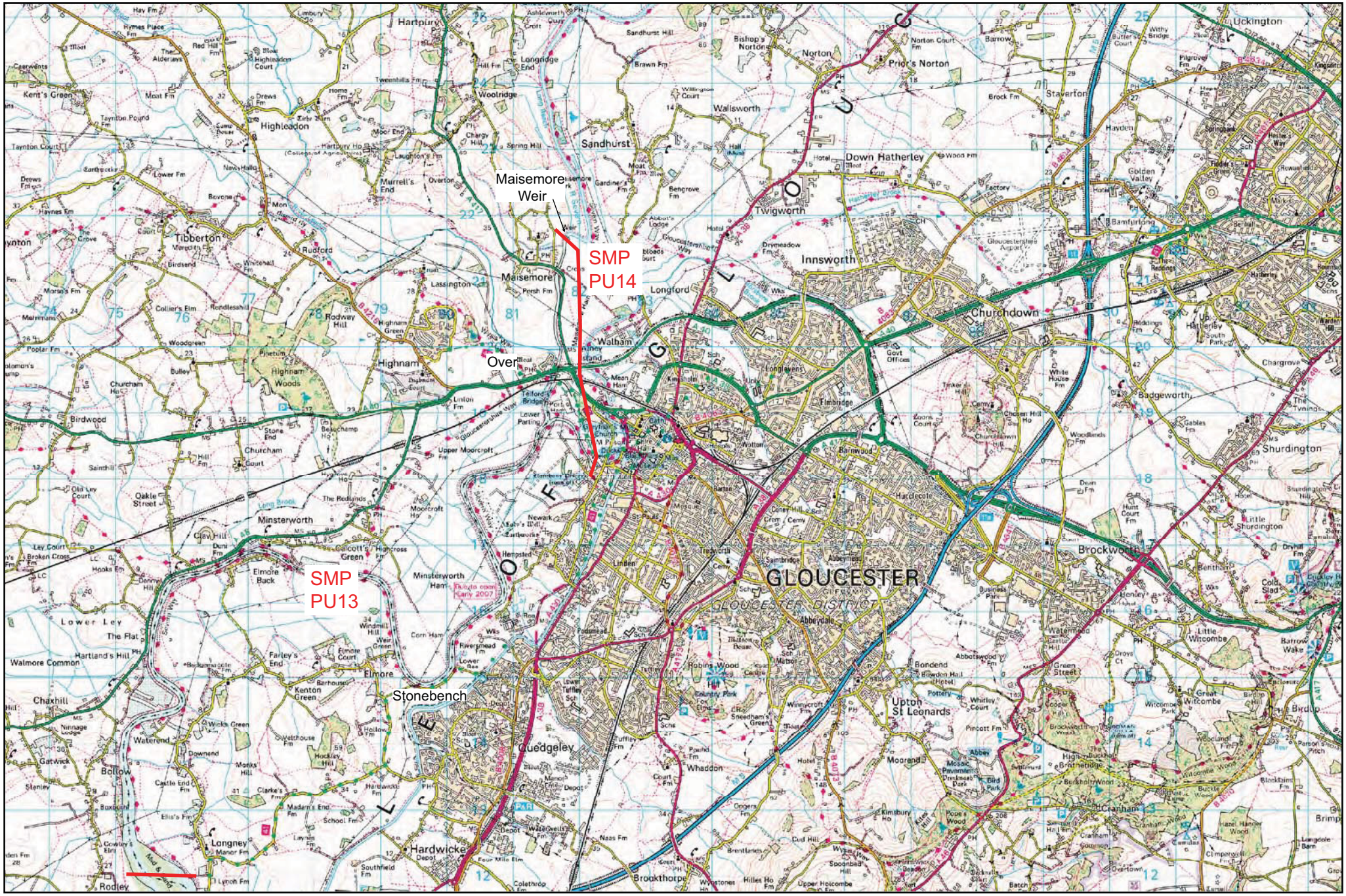

Figure 6: Gloucester to Maisemore

Figure 7: Severn Crossings to Avonmouth

Figure 8: Avonmouth to Clevedon

Figure 9: Clevedon to Brean Down

Figure 10: Brean Down to Burnham-on-Sea

Figure 11: Burnham-on-Sea to Kilve

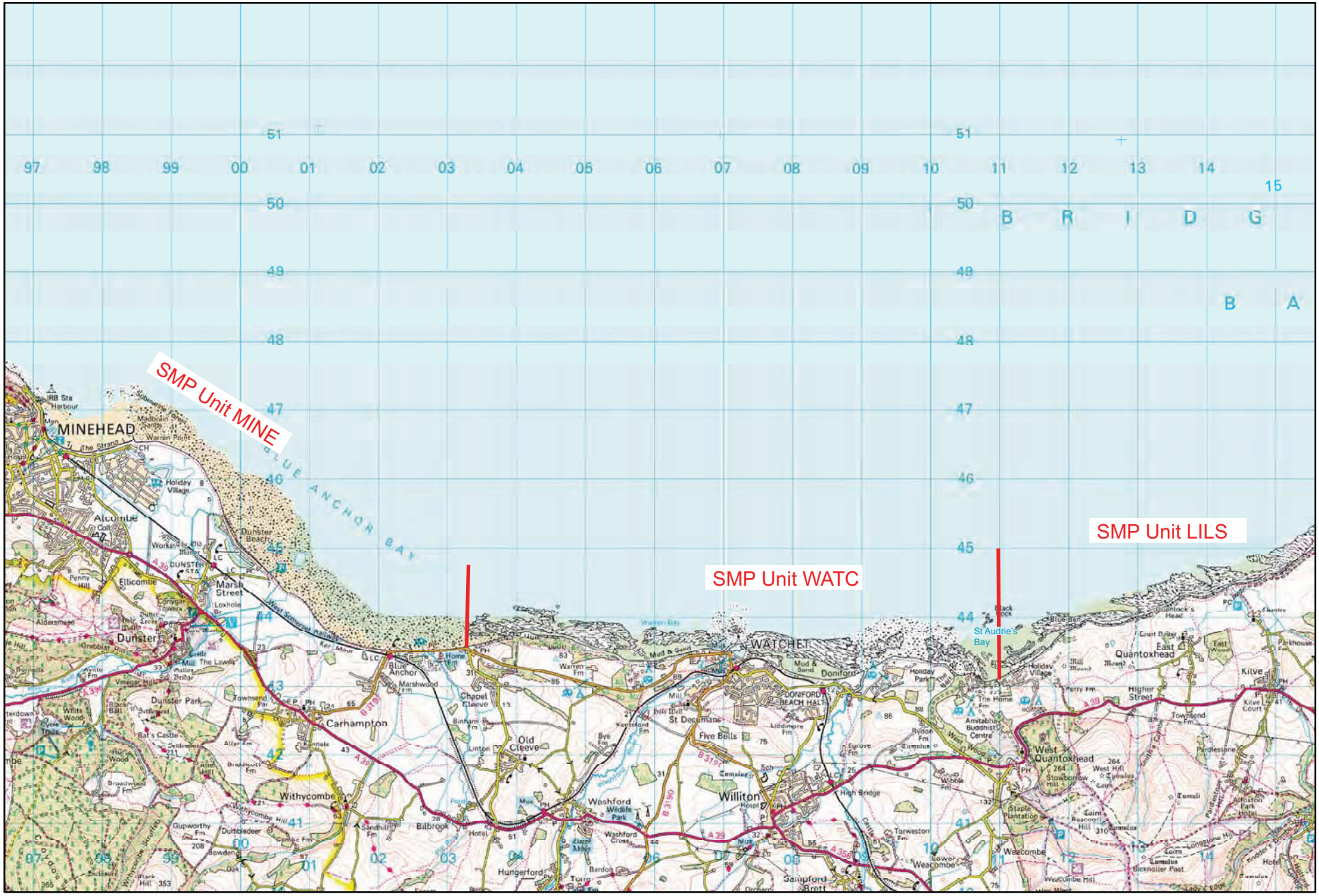

Figure 12: Kilve to Minehead

Figure 13: Minehead to Gore Point

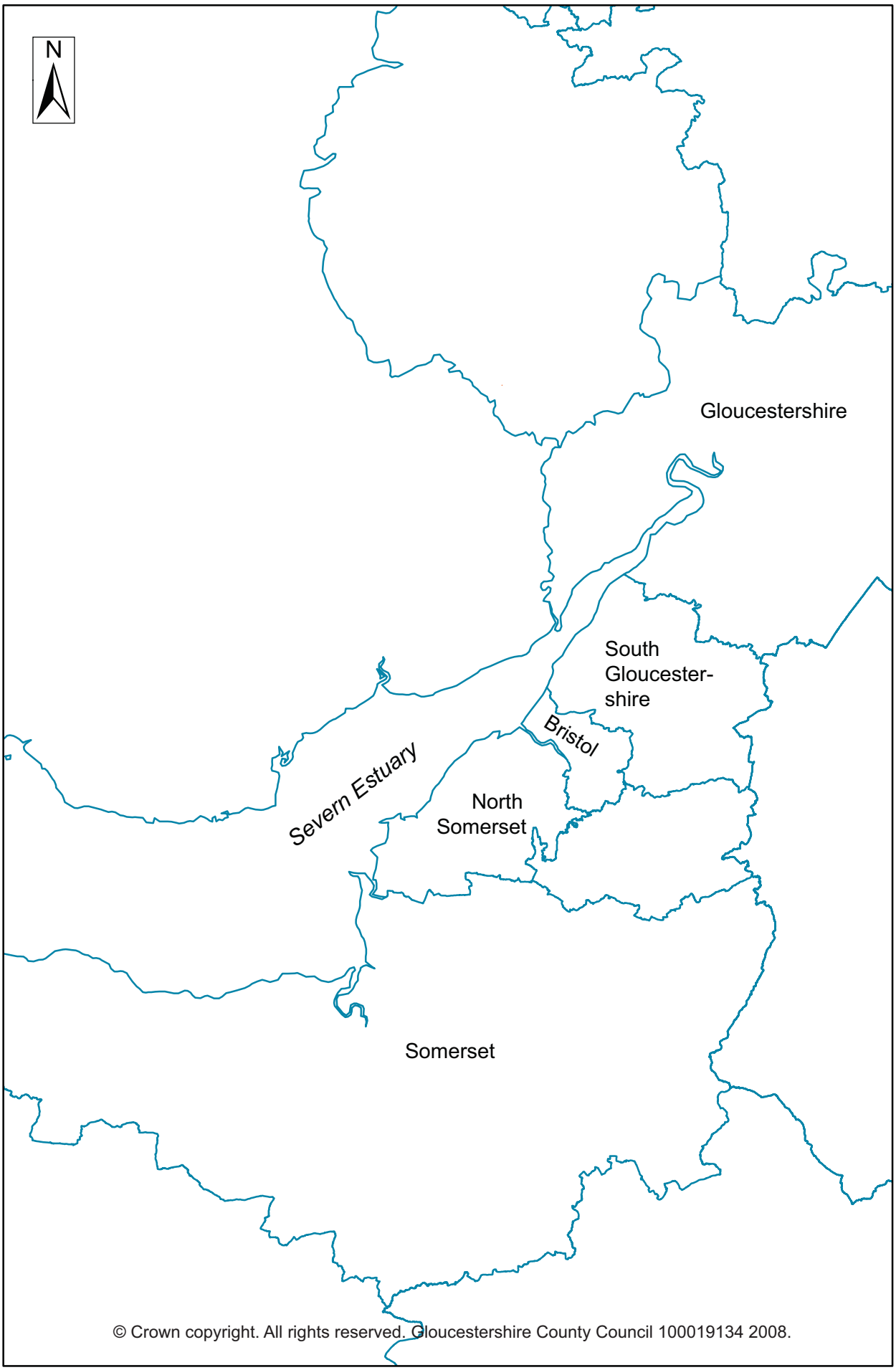

Figure 14: County and Unitary Authorities which provided HER or SMR data for the RCZA.

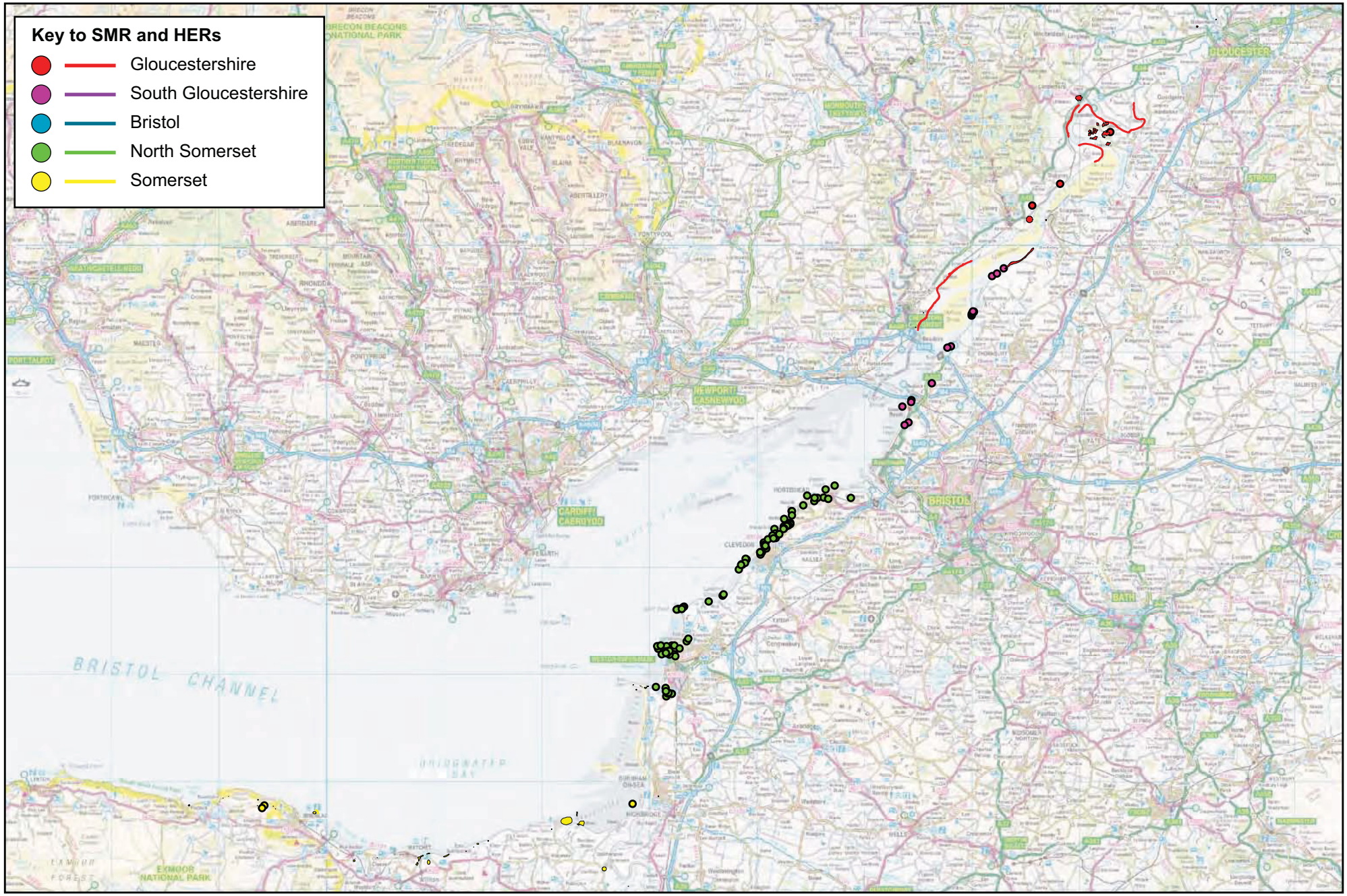

Figure 15: HER/SMR Data. Prehistoric Period

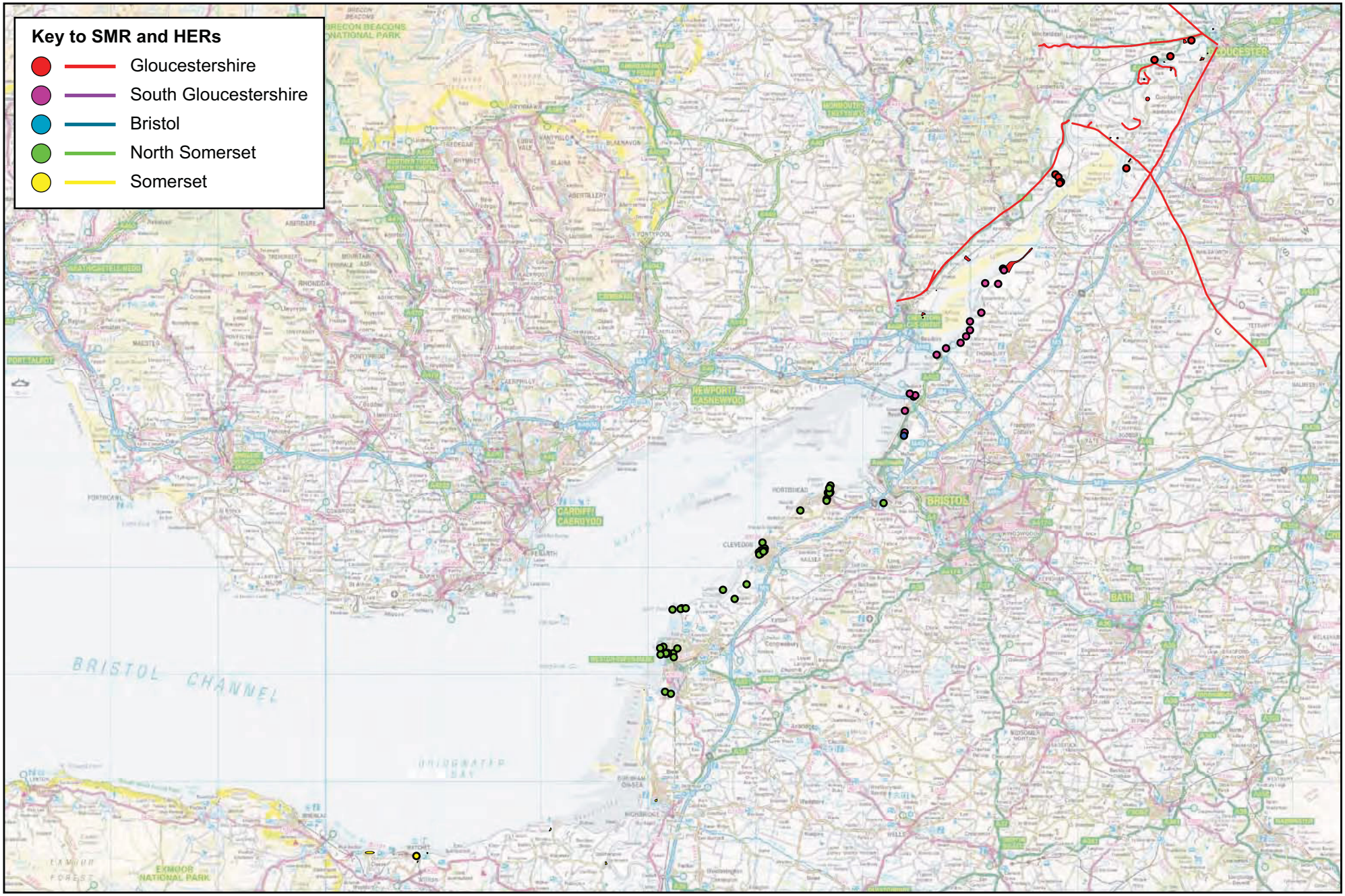

Figure 16: HER/SMR Data. Roman Period

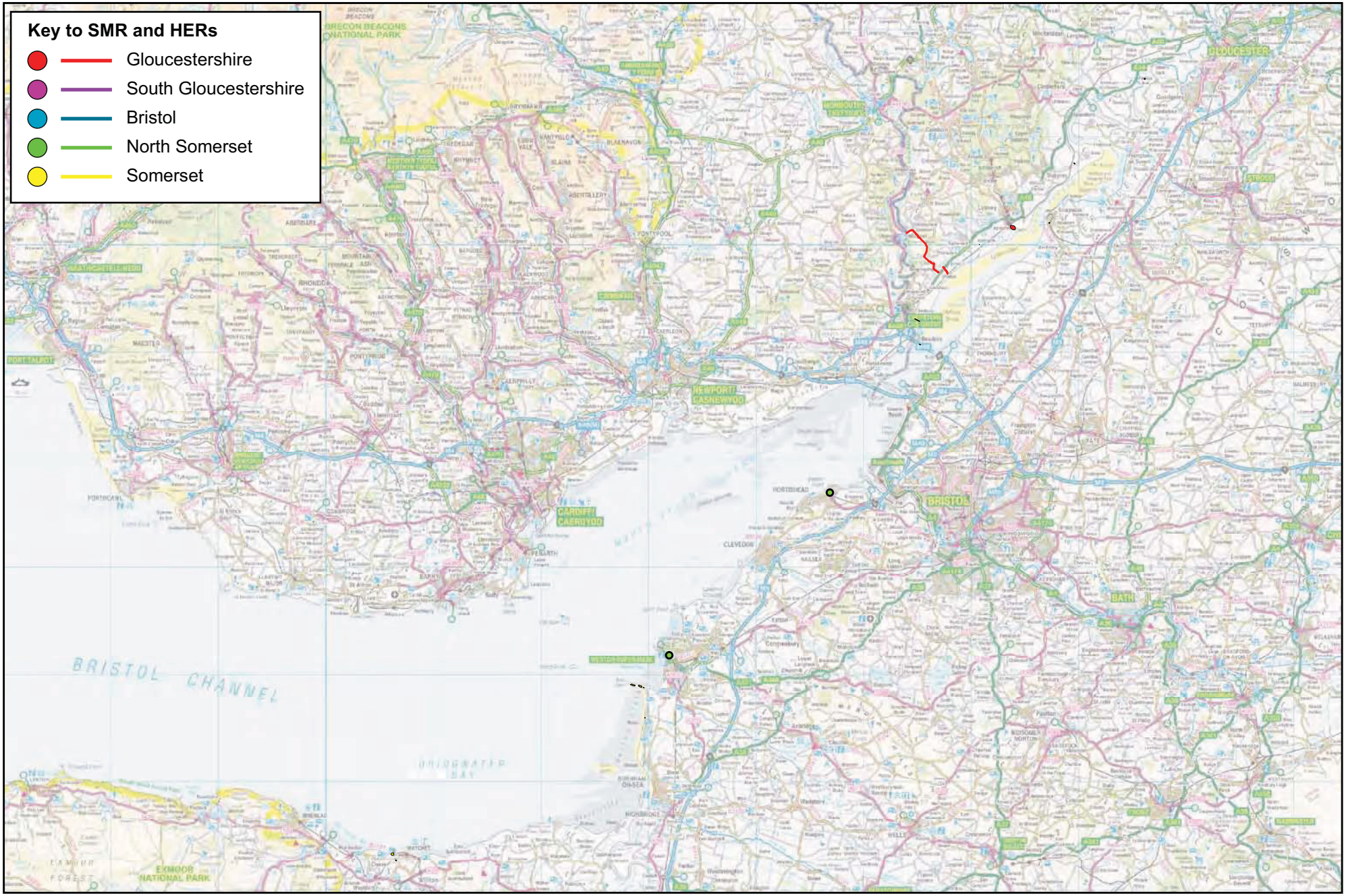

Figure 17: HER/SMR Data. Early Medieval Period

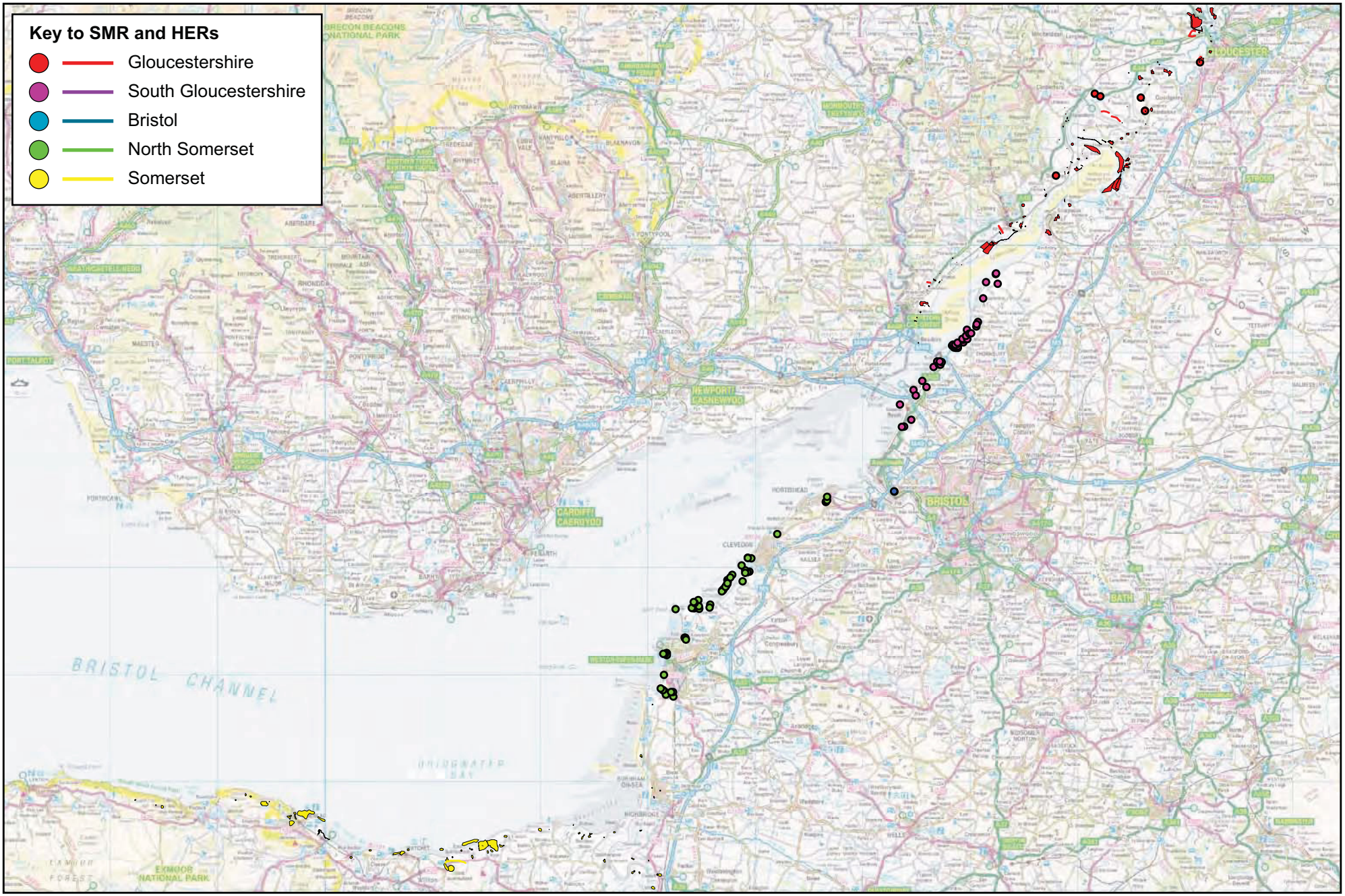

Figure 18: HER/SMR Data. Medieval Period

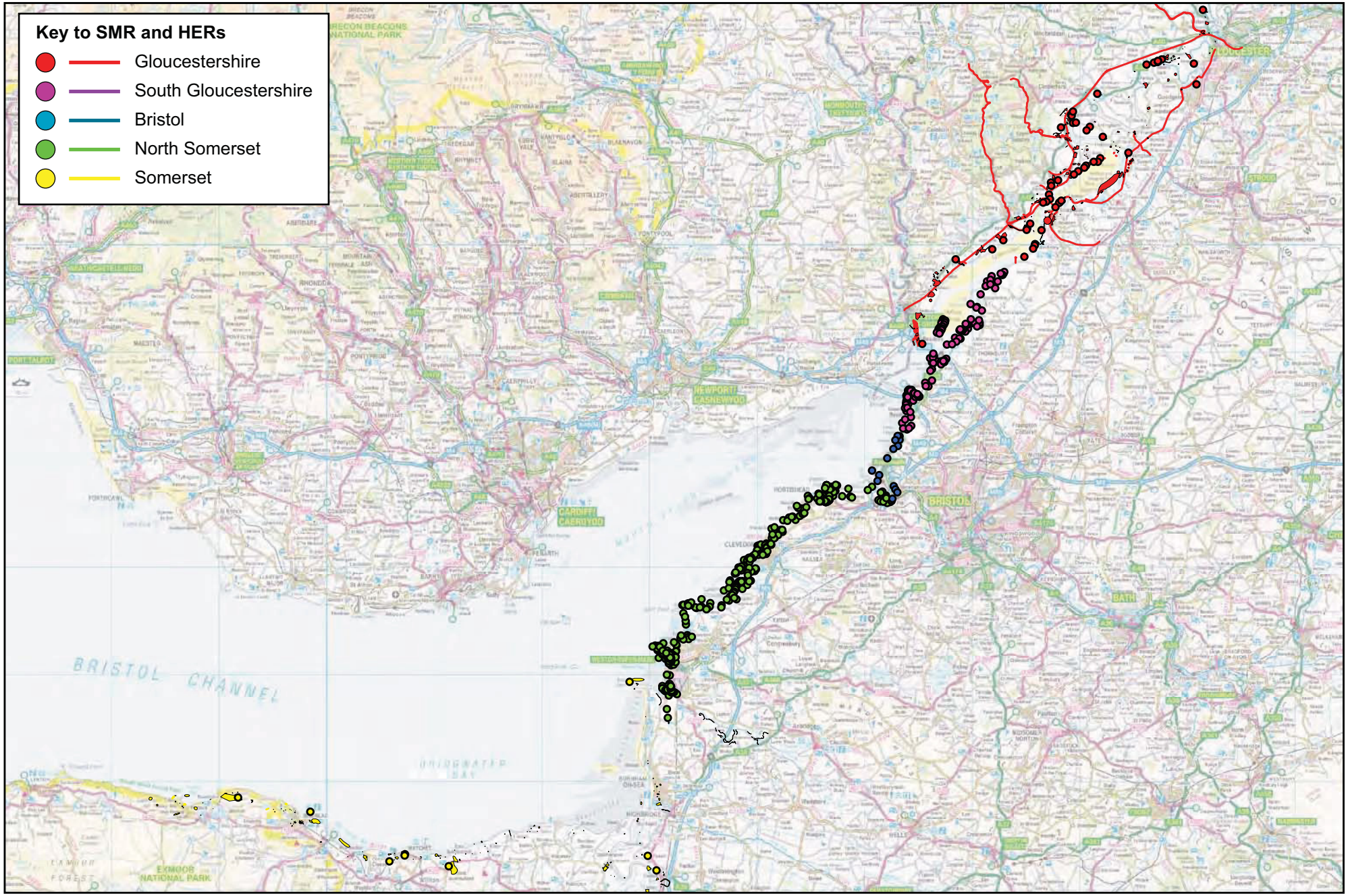

Figure 19: HER/SMR Data. Post-Medieval Period

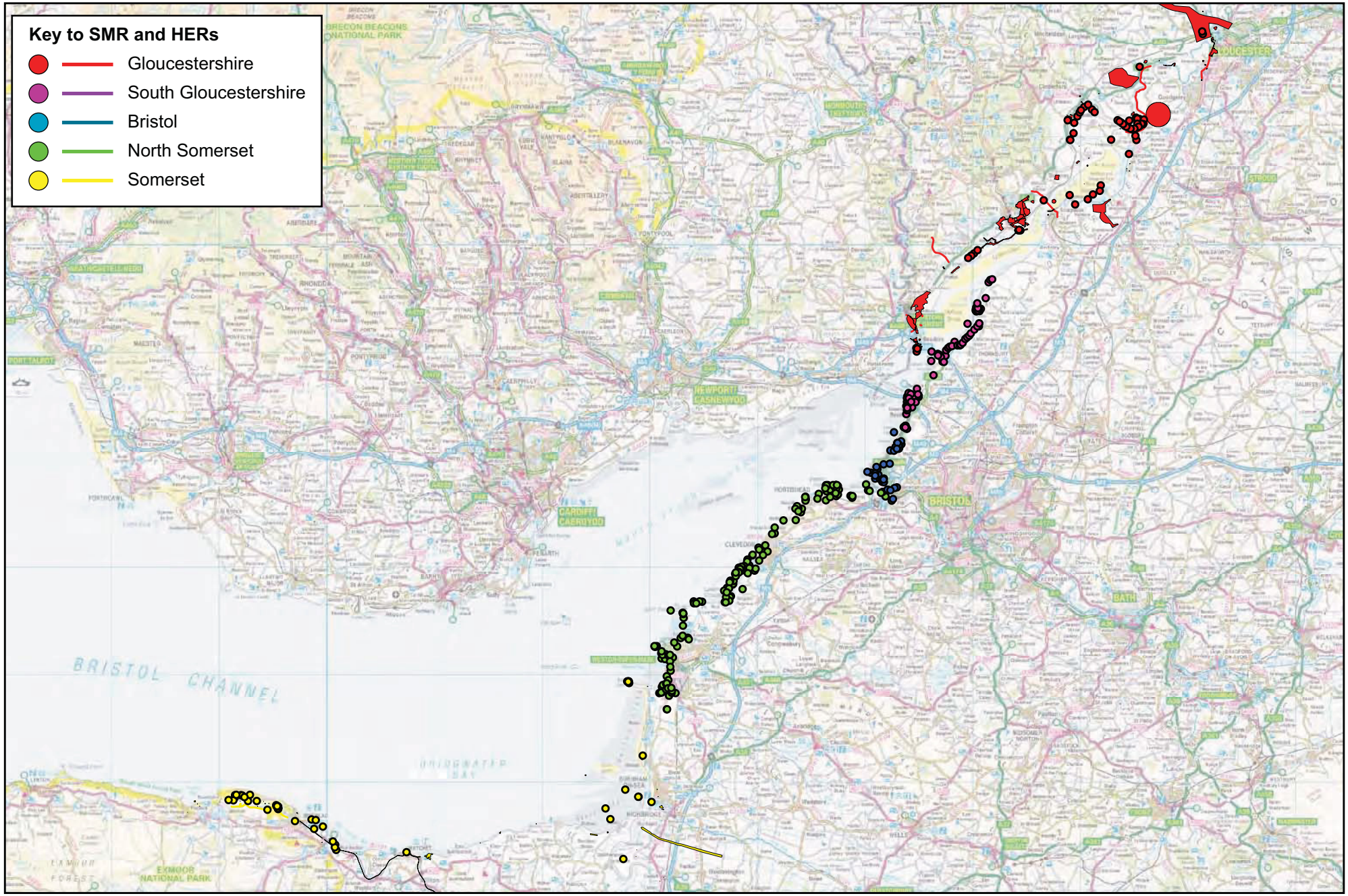

Figure 20: HER/SMR Data. Modern Period

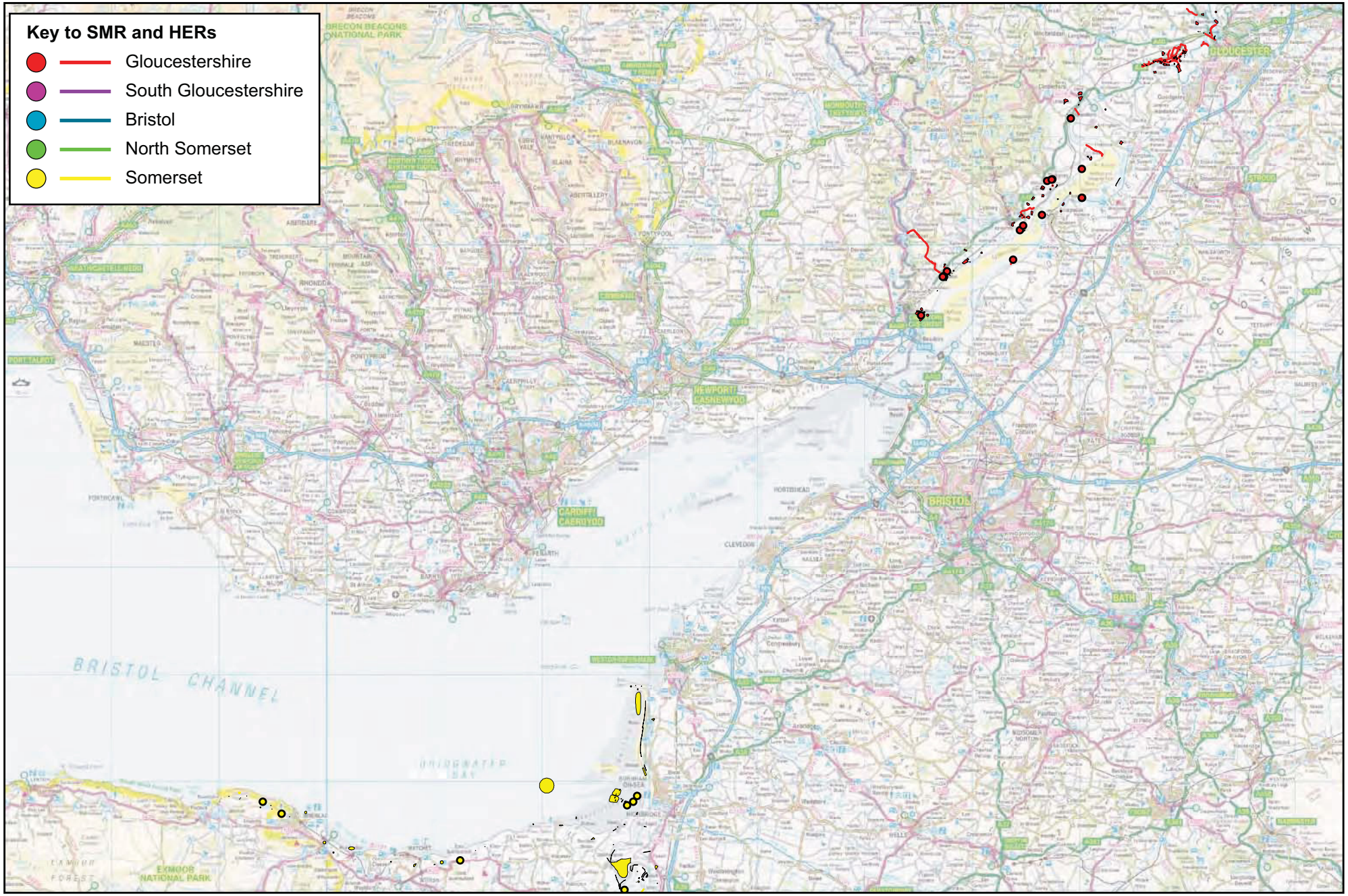

Figure 21: HER/SMR Data. Unknown Period

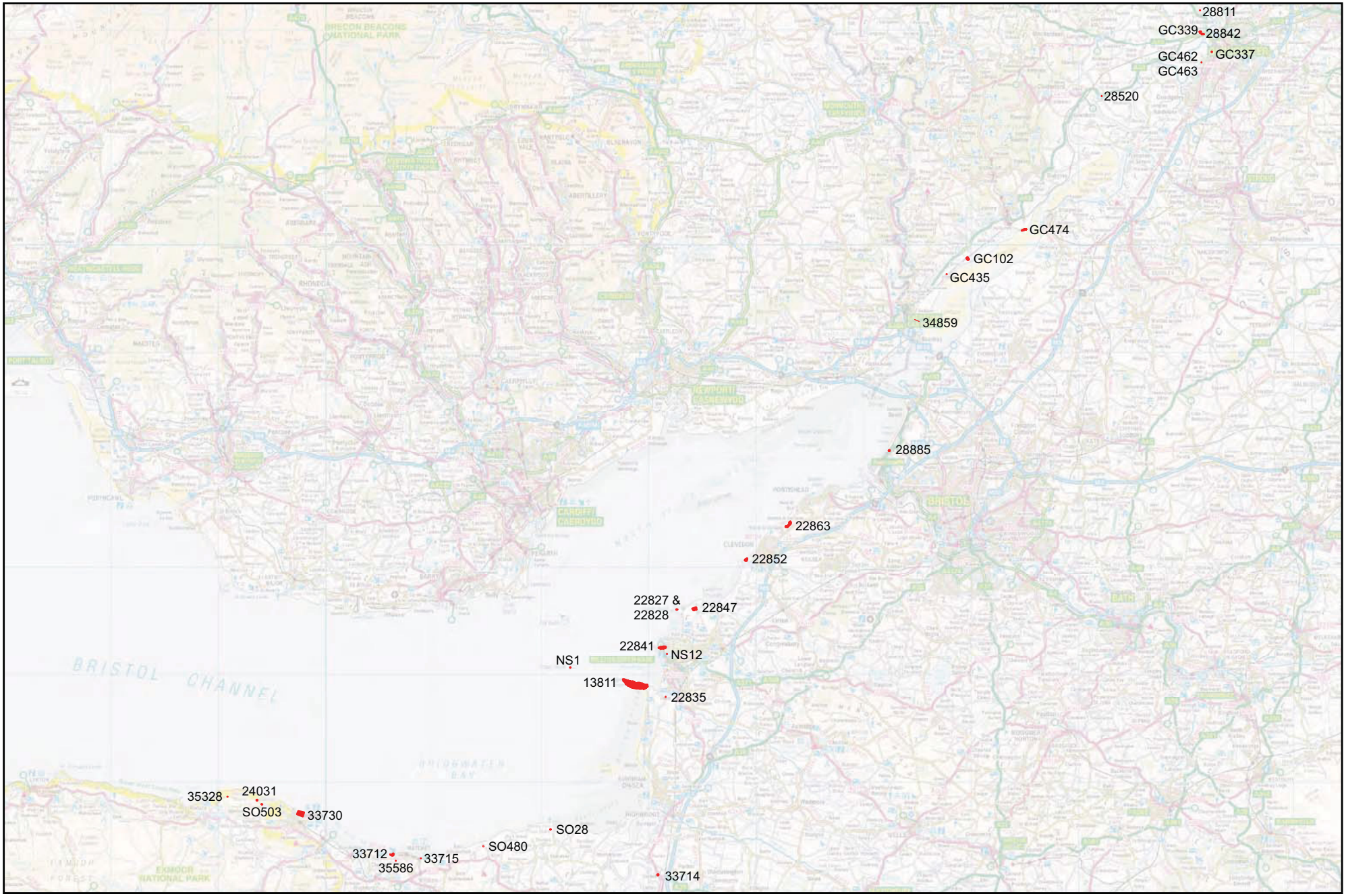

Figure 22: Scheduled Monuments within the RCZA survey area

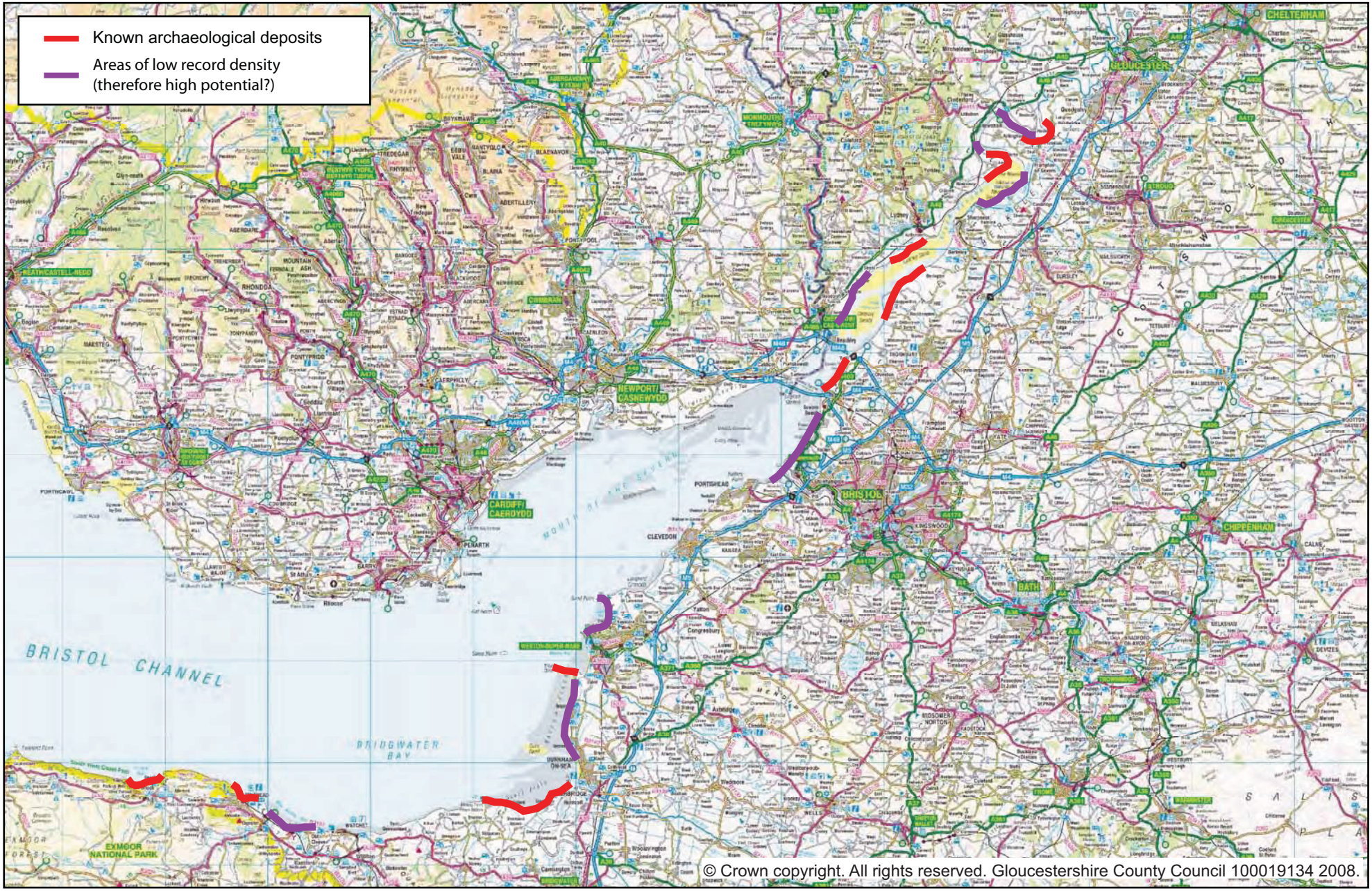

Figure 23: Areas of known archaeological deposits and high archaeological potential

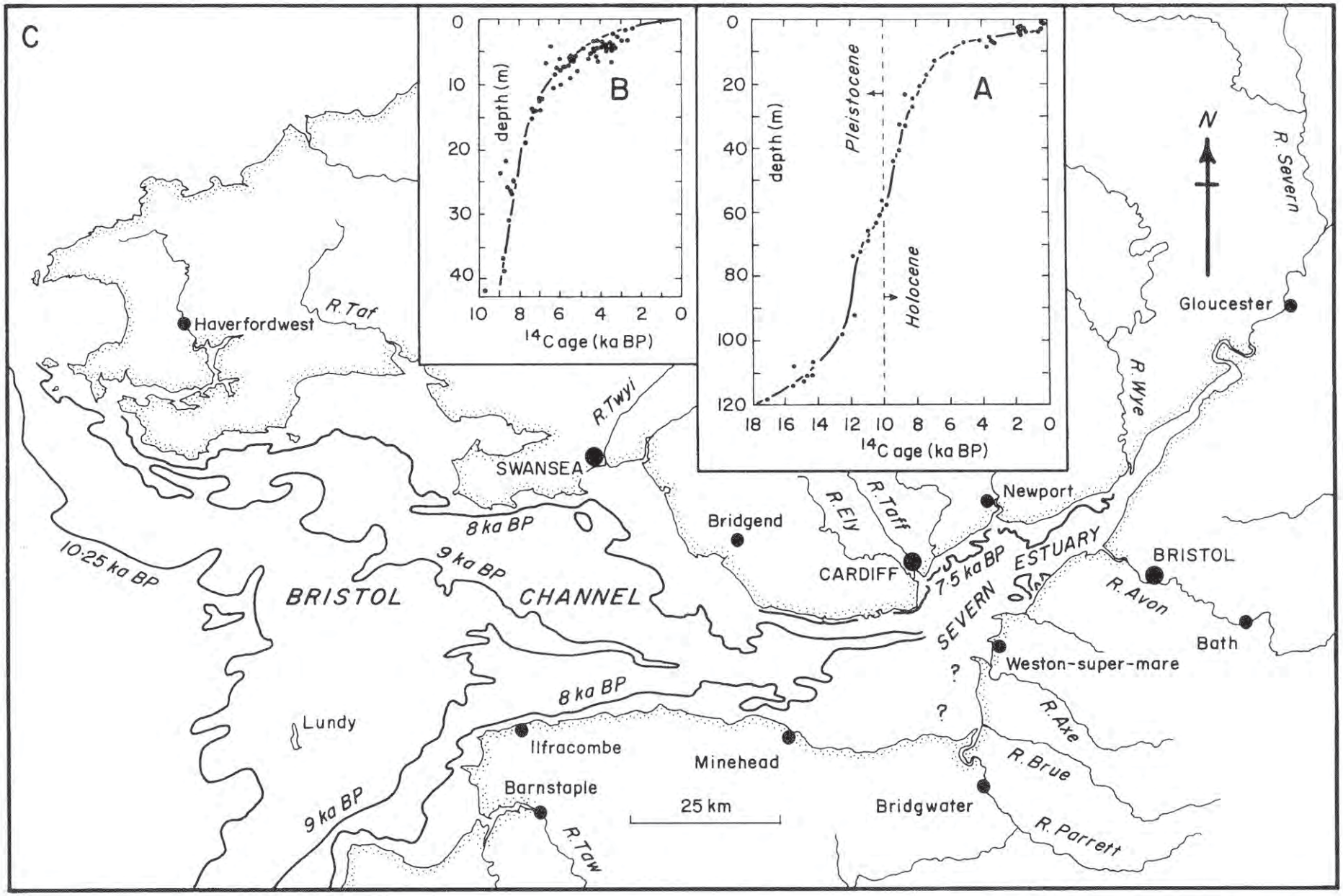

Figure 24: Post-glacial sea level rise (Allen 2001a, Fig. 4). A - Global rise from Devensian maximum. B - SW England from dated peats. C - Approximate shorelines.

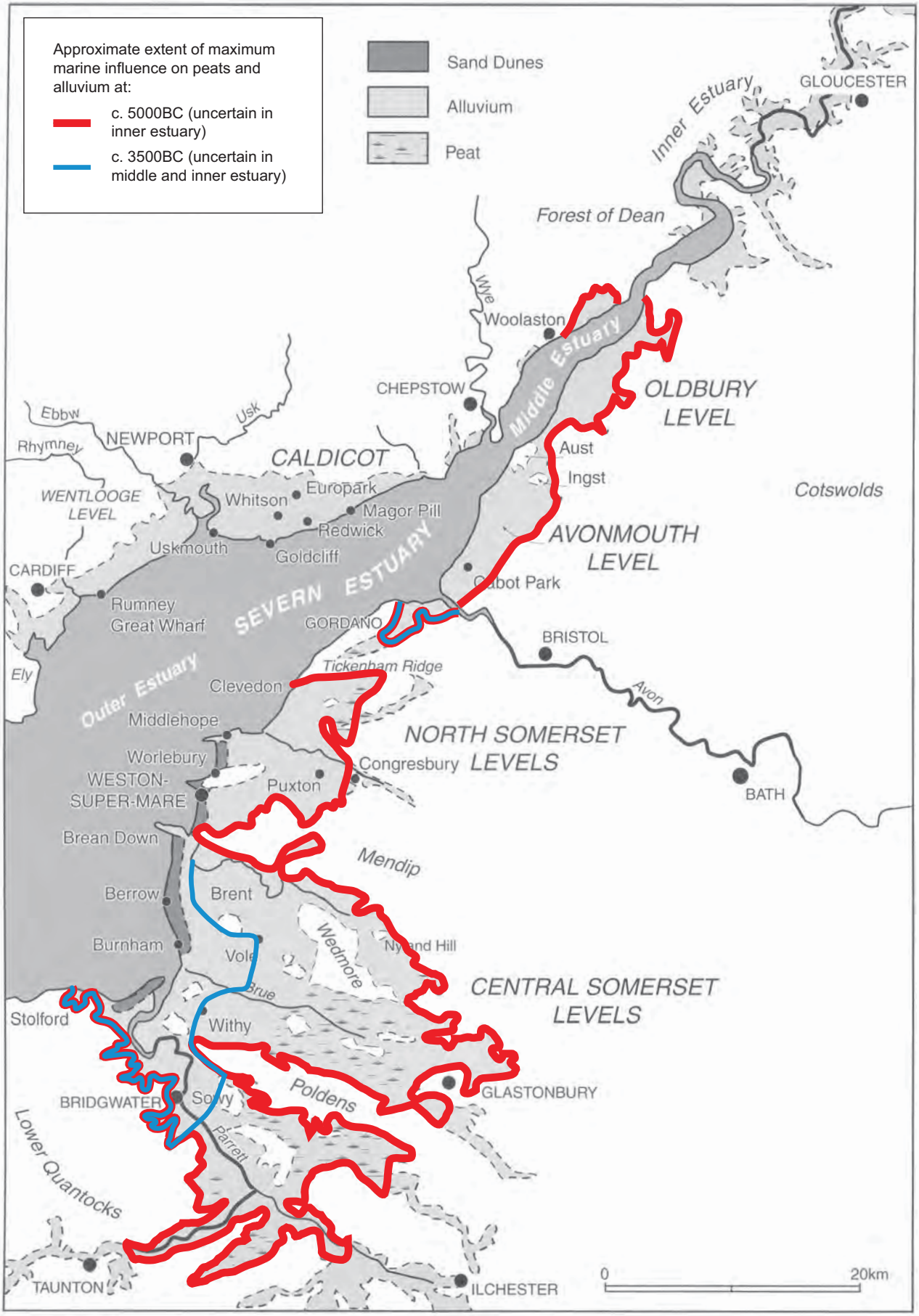

Figure 25: Late Mesolithic and Neolithic extents of marine influence
(Base map Turner *et al* 2001, Fig. 1)

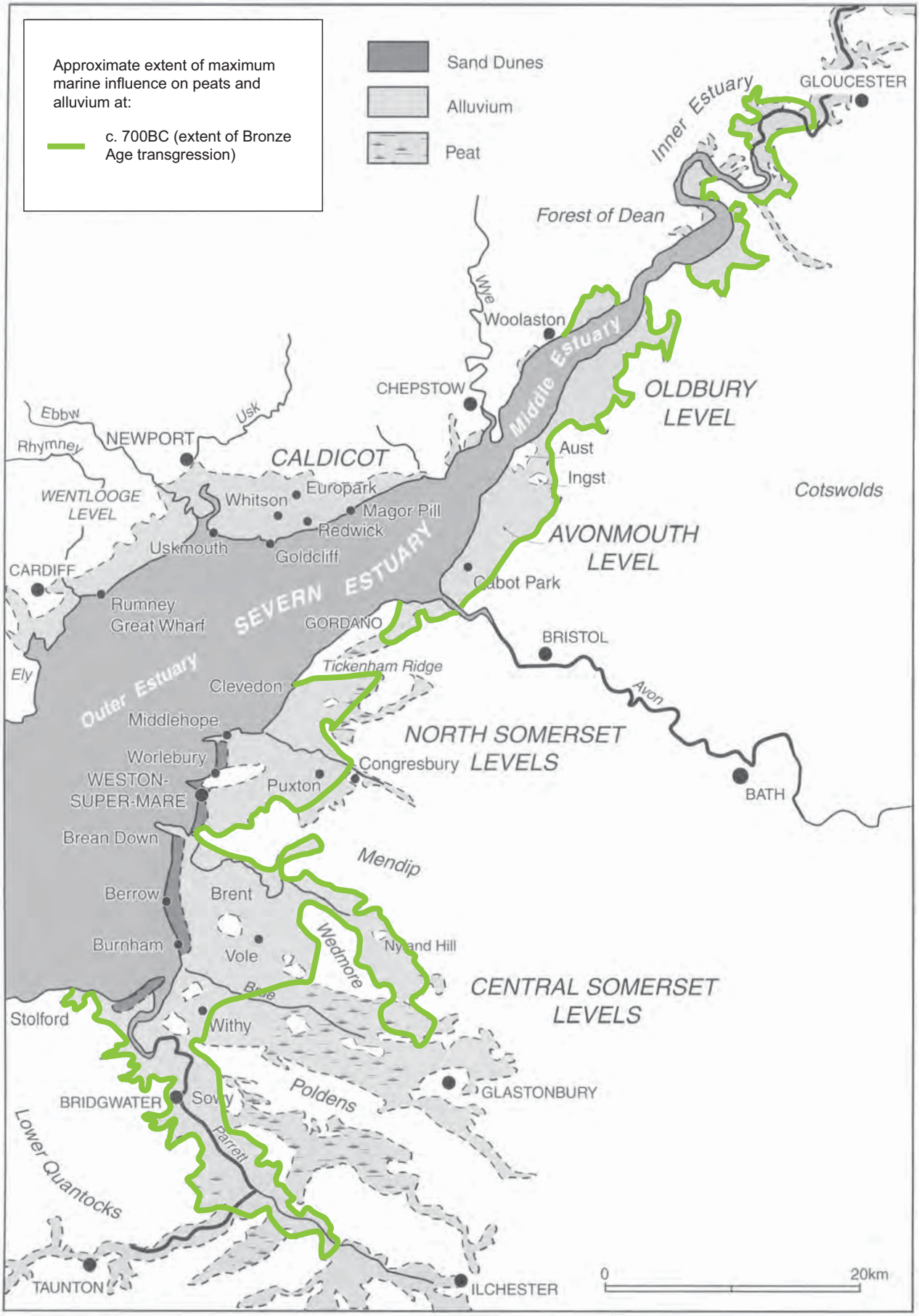

Figure 26: Extent of Bronze Age trangression
(Base map Turner *et al* 2001, Fig. 1)

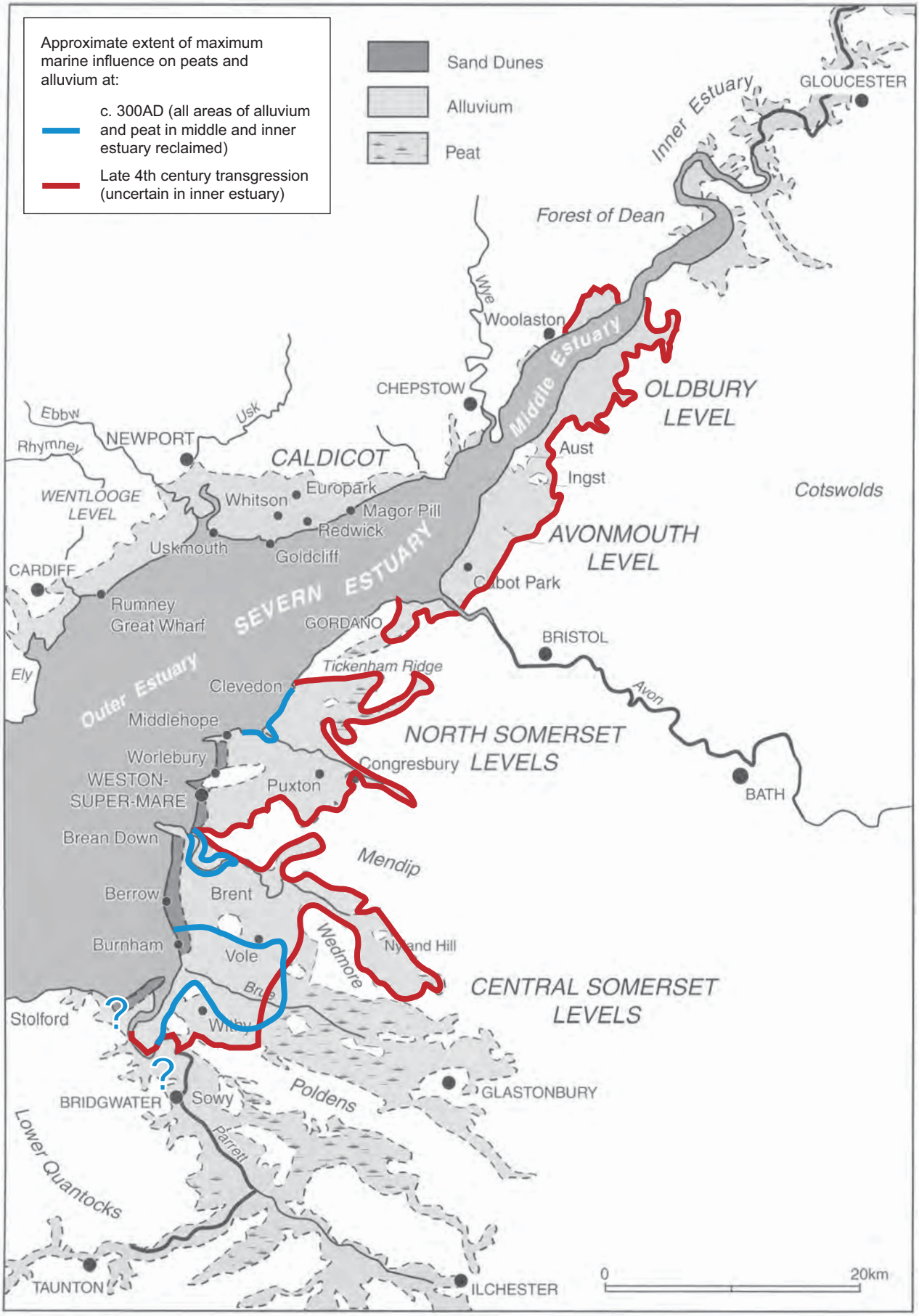

Figure 27: Roman period extents of marine influence
(Base map Turner *et al* 2001, Fig. 1)

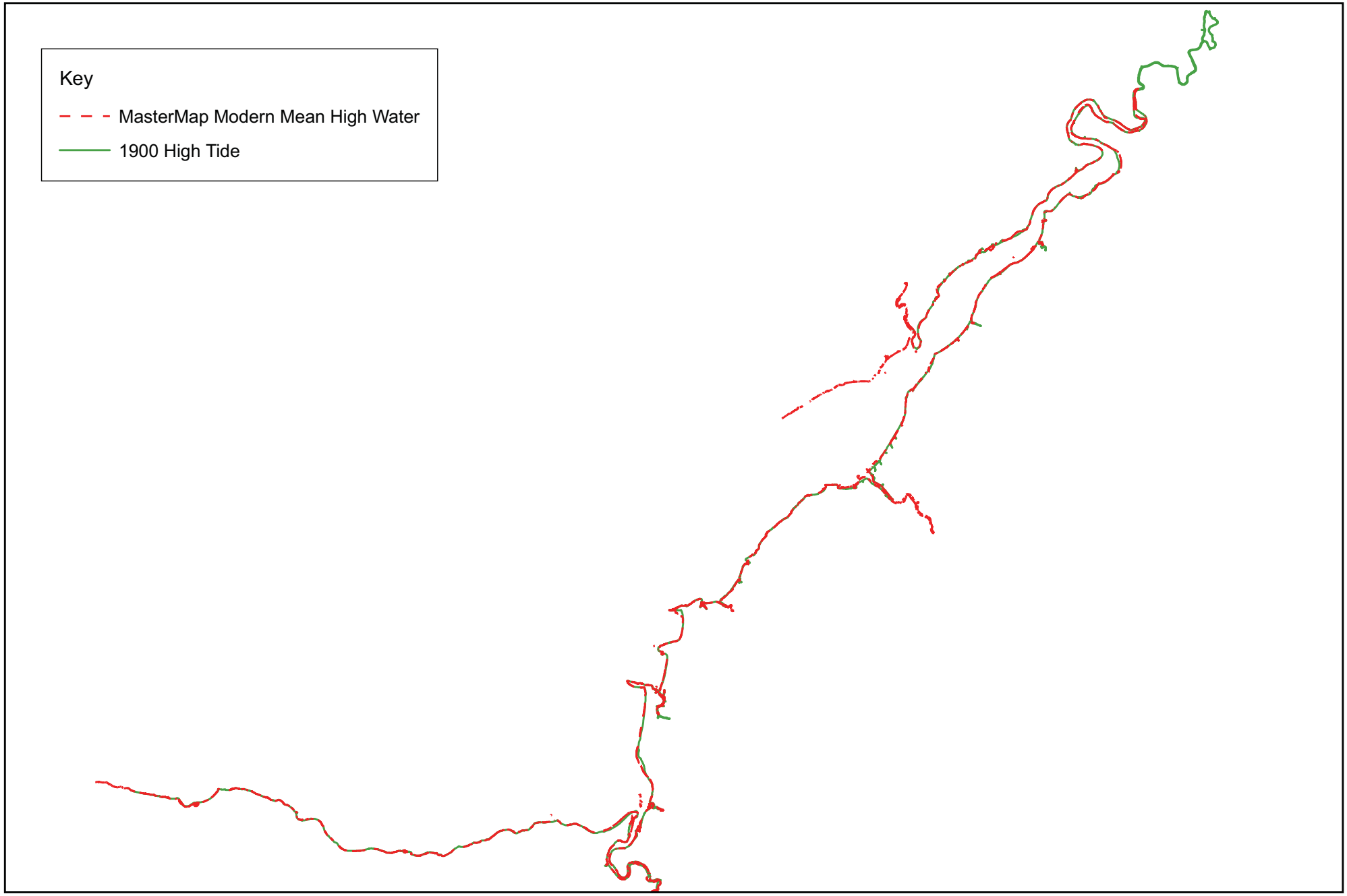

Figure 28: Modern and 1900 mapping of high tide

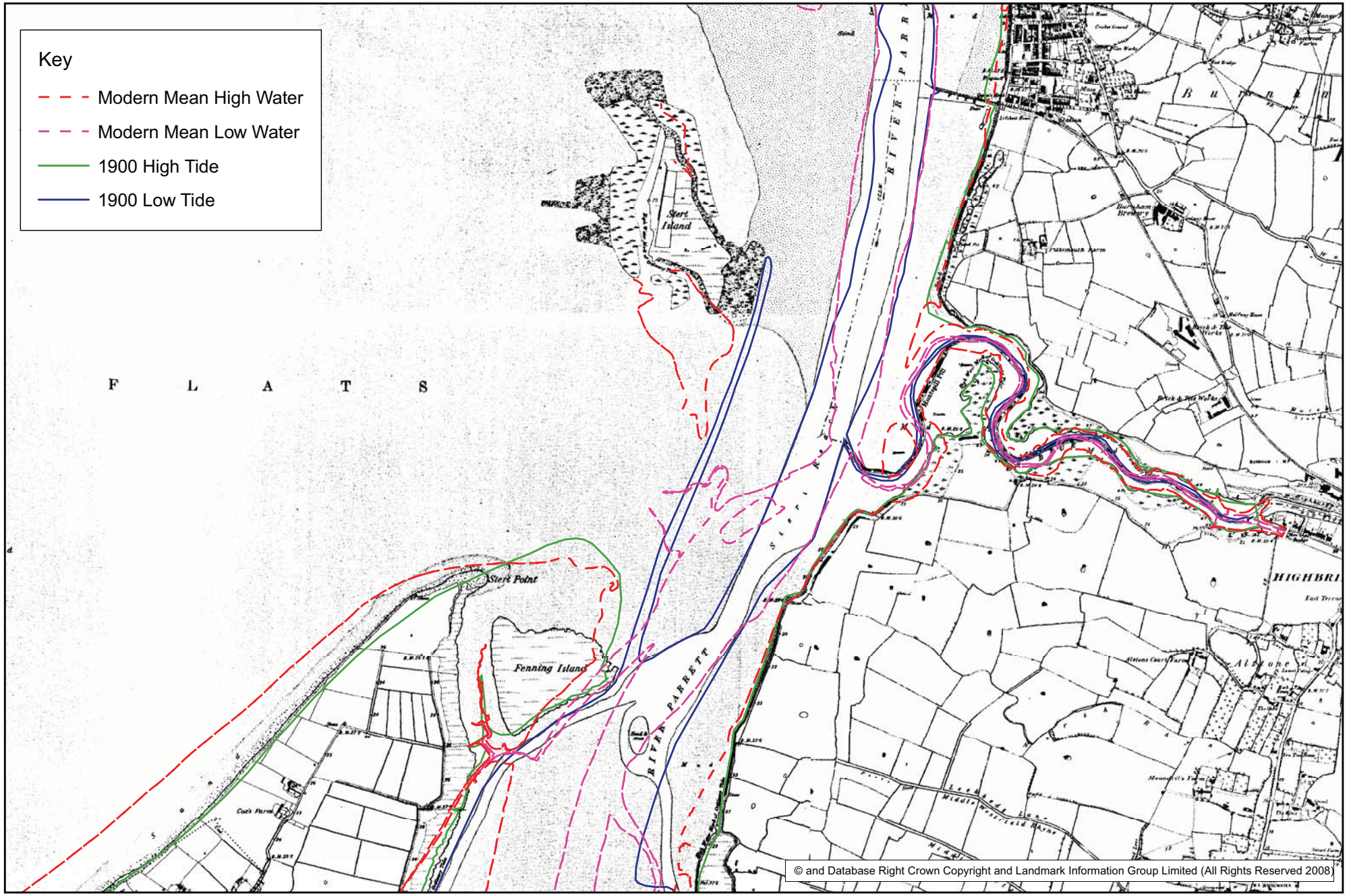

Figure 29: Changes to tidal range around Stert Point (base map 1880)

0 500 m

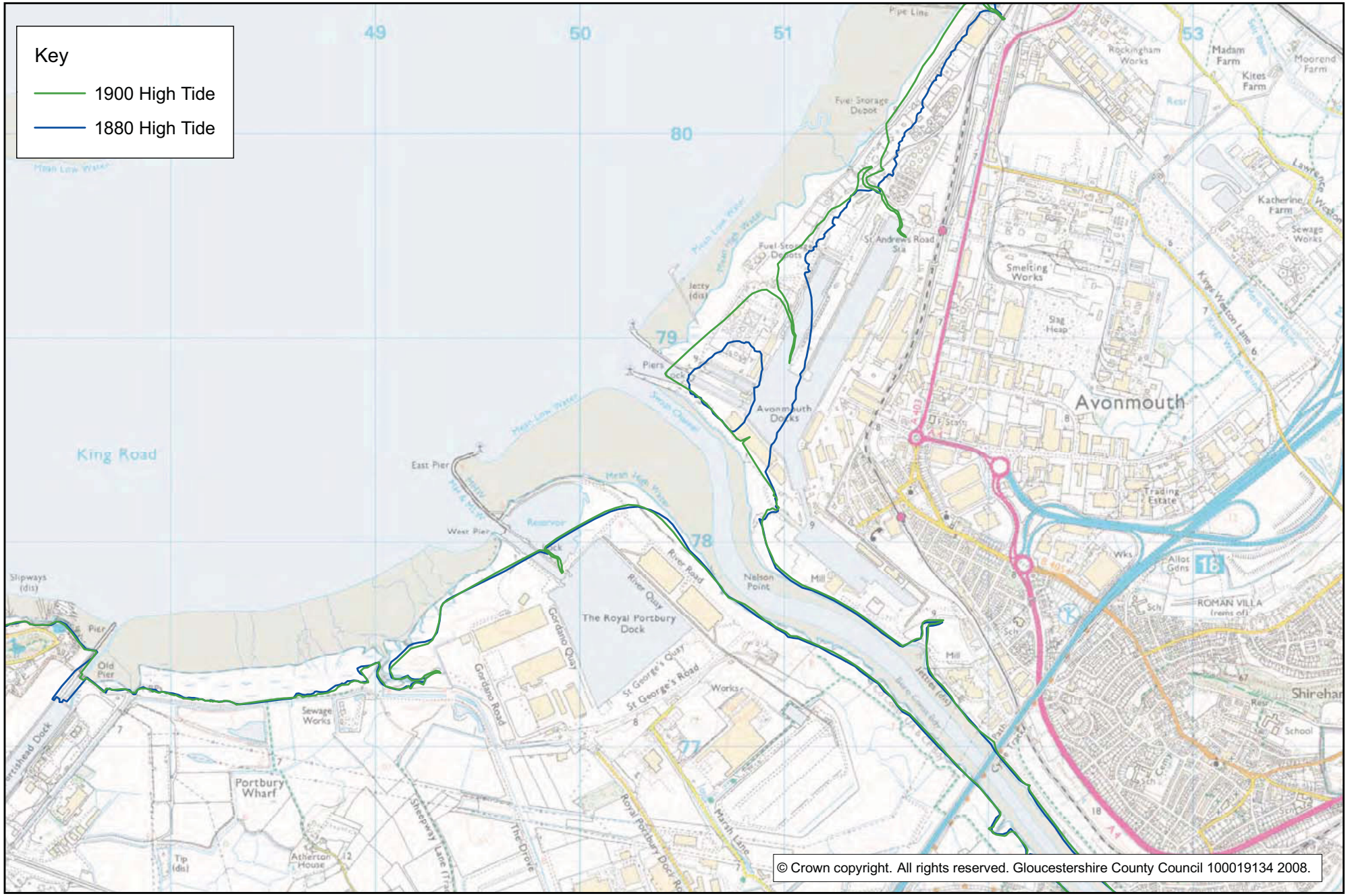

Figure 30: Changes to high water level caused by 20th century development at Avonmouth

0 500 m

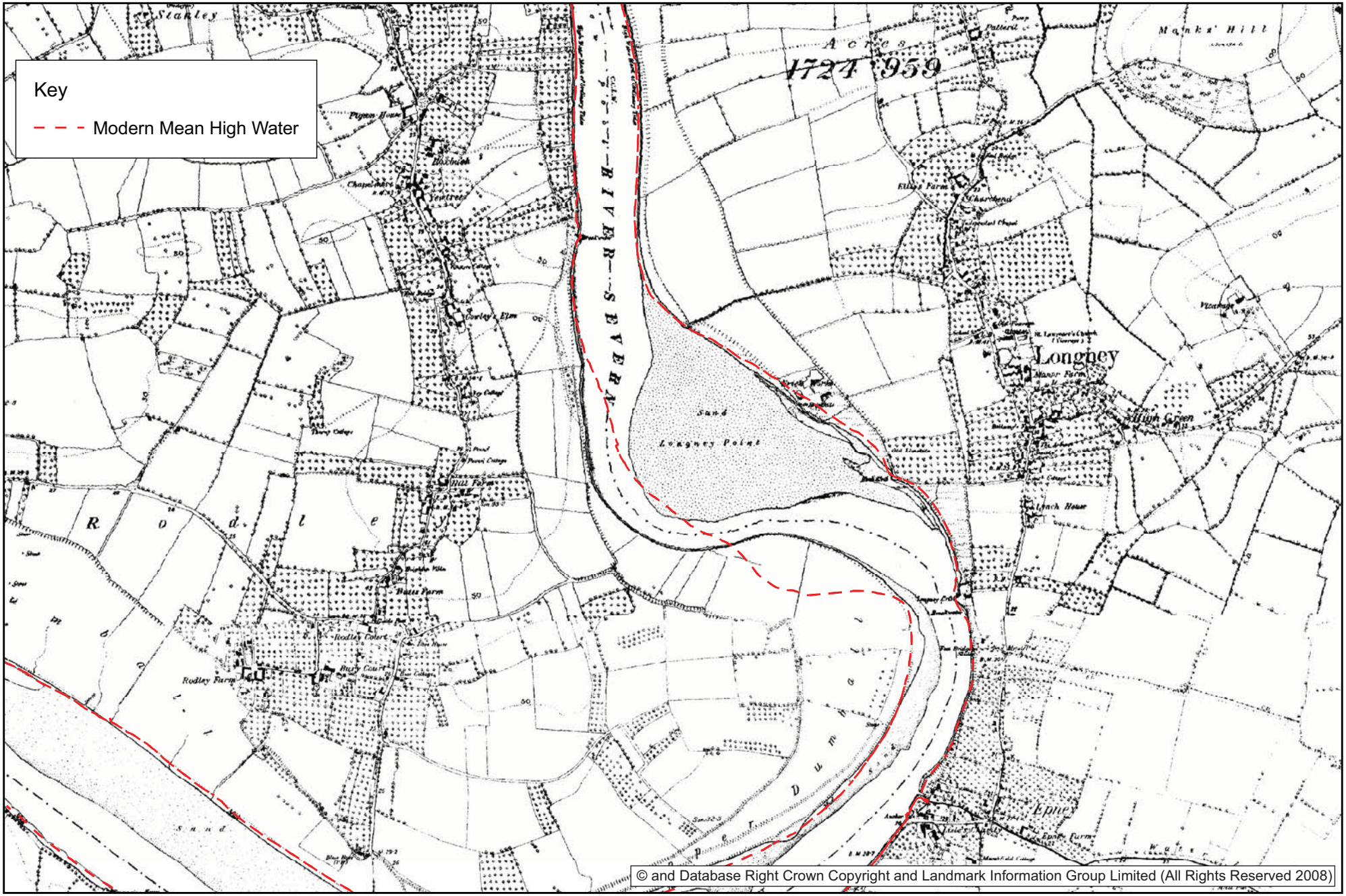

Figure 31: Changes to the course of the river between Rodley and Longney since 1880

0 500 m

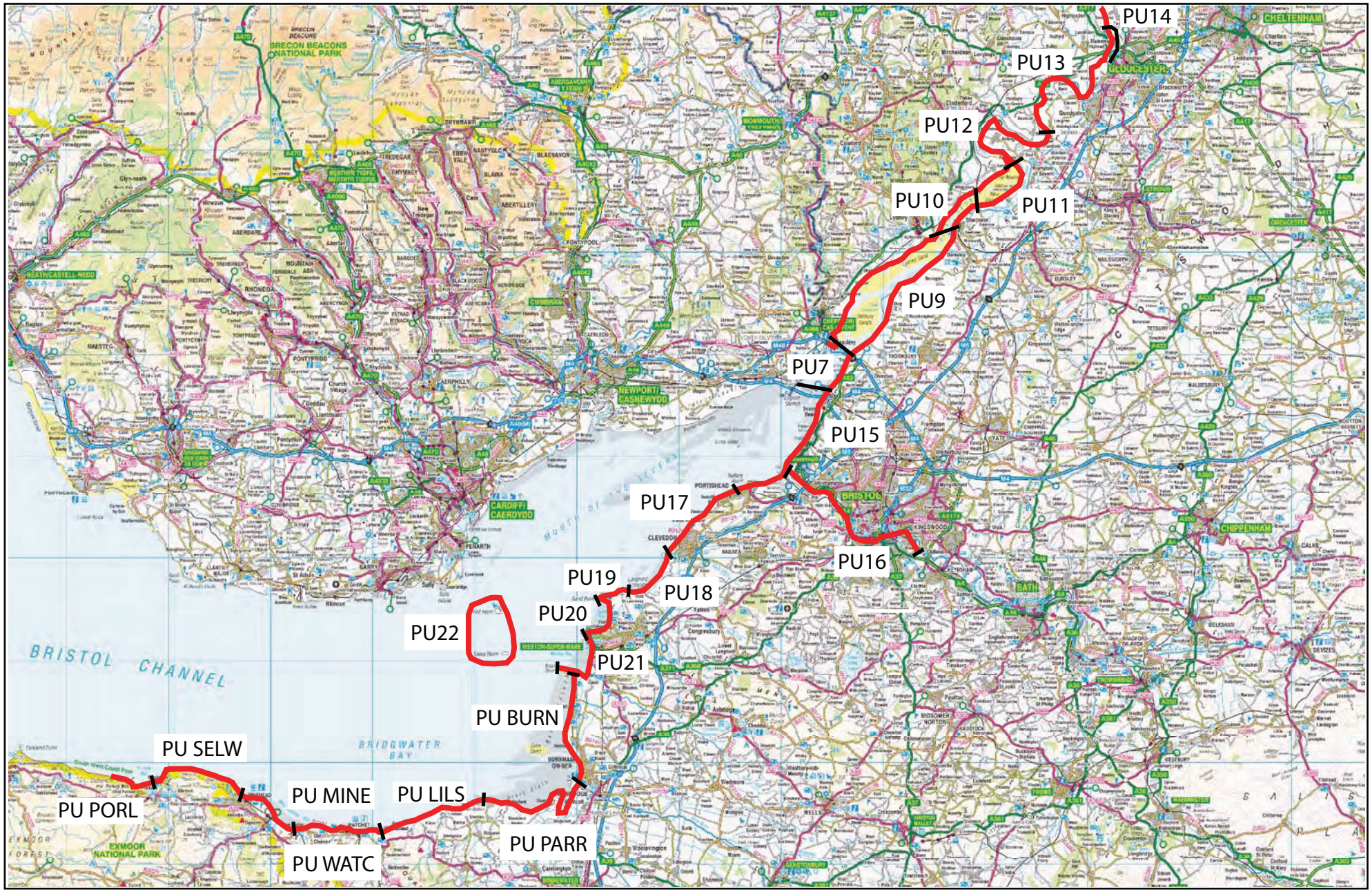

Figure 32: Overall plan of SMP Process Units in the RCZA survey area

Figure 33: FutureCoast: Areas of predicted coastal change (without defences)

Appendix A: Historic maps and charts consulted in Records Offices

Reference	Date	Title	Description	Notes	Assessment
Gloucester					
D149/T1004	1225	Grant of land in Frampton Marsh for 6 salmon putches near Bukepul	documents only		low
D421 L8	1682	Map of the New Ground at Lydney described in 1682 by Richard Croft	document bundle relating to legal case between Bathurst and Jones over ownership		low
D6/E4	1700	Survey of Certain Estates belonging to Benjamin Hyett in the County of Gloucester	bound book of surveys showing boats, sandbanks and river walls		low
D326/L2	1721	Map of fisheries at Elmore and Framilode	shows Elmore and Epney weirs		low
D3398 1/1/33	1721	Fisheries in Elmore and Framilode	shows names of owners		low
D2998/1	1725	A Map of the Manor of Arlingham in the County of Gloucester	shows Arlingham peninsular	Boats shown on river	low
P152/IN 1/2	1738-9	Note about building Hock-Crib sea wall	documents only		low
P298 MI 10	1752	Agreement about land cast-up by the river at Slimbridge	documents only		low
D2426/P1	1757	Plan of the Estate of William Jones and John Guise	similar to D2426/P2 but less detail		low
P218a/MI1	1757	Plan of the Estates of Charles Barrow in the Parish of Minsterworth			low
Photocopy 283	1772	Map of the Estate at Dinny in the Parish of Minsterworth and Doodlings Farm in the Parish of Longney	shows sea wall on S bank of river and boats and fishermen		low
D326 E2	1774	Terrier of Lands Owned by William Jones & John Guise in Highnam, Over and Linton in the Parish of Churcham	inserted sketch map of lands adjoining River Severn		low
D149/P11	1800	Plan of New Grounds, Slimbridge	shows Frampton Pill and Slimbridge Warth		low
D134/P10	1825	Plan of the Hay-Hill Estate in the Parishes of Newnham and Awre	shows wharf at Bullo Pill but no detail of buildings etc		low

D272/9/2	1835	Map of the Lower Level of the County of Gloucester. The Lower Division	shows Avon Battery, Dundall Island and sea defences		medium
D272/9/3	1835	Map of the Lower Level of the County of Gloucester. The Upper Division	shows Bull Inn/Bullow Passage, New Grounds at Slimbridge and decoy pool at Hamfallow		medium
D2426/P2	1841	Map of the Highnam Court Estate in the parish of Churcham	shows Over Bridge, River Leadon and Hereford & Gloucester Canal		medium
MA19/41	1843	Chart of the Severn below Gloucester	navigation chart shows brick kilns at Longney, "ground newly warped up" at Slimbridge, East Point Fort at Avonmouth		medium
MA19/42	1850	Survey of the Severn by Capt. Beechly, RN, FRS	very detailed chart with fish weirs, piers, stakes shown	difficult to use as rolled	high
D1501	1860	Map of the Parish of Minsterworth in the County of Gloucester	shows fishery boundaries		low
D650/15	1861	Plan of the Parish of Slimbridge	shows "land in the course of being reclaimed from the Severn. Decoy Pool, breakwaters and old sea wall		medium
D18/406-425	1882	Arlingham Shores, showing situations of breakwaters immediately required	document bundle relating to Arlingham Shores	other documents relate to 18th and 19th century flood defence	low
D4170 1/1	1904	New Sea Wall at Bollow	document bundle with maps, specifications etc for the new wall		low
D421 E38	nd	Map of land adjoining River Severn	from Cone Pill to beyond Purton Pill	no scale	low
Bristol					
Bristol Plan/Arranged/ 245	1693	The River Avon from the Severn to the City of Bristol	shows vessels on the Severn, anchorages in the Avon and the place at which King William landed in 1690		low
38035 (BP244)	1794	New Improved Chart of the Bristol Channel			low
07787 (1) a.2	1832	England West Coast. Bristol Channel Inner Part	chart showing sandbanks etc	poor detail	low
31965 STG/14	1841	Plan of Parish of Burnham	shows Brue/Parrett confluence and "baths"		low

38035 (BP244)	1847	Chart from Dunball Island to Woodhill Bay			low
35192/x/12	1866	Certificate for Privileged Engines	documents and map of putchers at Chapel House		high
07787 (1) c.2	1868	Chart of part of the Bristol Channel	covers large area in little detail		low
31965 STG/81	1877	Somerset Drainage Act 1877. River Parrett Division	shows Steart Point, sea wall and pebble bank		low
07787 (1) b	1880	England West Coast. Bristol Channel King Road	shows Avonmouth and Portishead docks. Battery at Portishead Point and rifle range N of Avonmouth Hotel		low
07787/1d	1886	Charts of Bristol Channel		unfit for production	
7790/53	1895	Plan and Section of Portishead Pier			low
DocksPlans/Arranged/54	1905	Chart of Nash Point to New Passage		unfit for production	
41545/1	1933	England West Coast. Newport and Western Super Mare to Chepstow and Bristol		poor detail	low
41545/2	1934	England West Coast. Bristol Channel King Road	shows enlarged Avonmouth Docks		low
07783 (18) c/23	19th century	Sanitary districts in Somerset	drainage board map	poor detail	low
07783 (18) c/23	19th century	Sanitary districts in Gloucestershire	drainage board map		
248 (4)	19th century	Petition against act for erecting locks on the Severn		documents only	
40762/8	19th century	Nass Sands Lighthouse	engraving only		low
07787/1e	nd	Plans, charts etc of Bristol Channel		unfit for production	
07787/11	nd	Ordnance Survey showing tides in river		missing	
32835	nd	Aust Ferry	documents from 1631, 1656 and 1732	documents only	
00546 (62)	nd	Plan No.3 Portishead Docks	low detail		low
39290/FW/LN/17	nd	Chart of Bristol Channel from Arrowsmiths Tide Table		poor detail	low

40145/ph/9 (I)	nd	Map of Port of Bristol	limits of Port and Harbour of Bristol		low
5139 (29B)	nd	Indenture	mentions fisheries	documents only	
4480	1736 - 1743	Maps and Plans "Surveys of the several City Lands belonging to the Chamber of Bristol"	fiche of maps including Redwick, Northwick and Portbury, also some Gloucestershire property.	shows seabanks on River Banwell	medium
Taunton					
D/RA		Somerset Rivers Authority	records from 18th century onwards: 135 boxes, 100 volumes, 101 rolls and 30 glass negatives in collection		
T/PH/gc 11	1714	Porlock Manor Court Book 1705-1717	agreement for the erection of sea walls 1714	documents only	low
D/RA/5/1	1867-1925	Avon, Brue and Parrett Fisheries District Acts and Orders	description of numbers of putchers on the Severn and Parrett	documents only	low
D/RA/2/9/34	1907	Royal Commission on Coastal Erosion 1906-8	describes sea defence work at Steart 1927, Burnham sea walls and RAF bombing range at Stert	documents only	low
D/RA/1/2/59	1907	List of works in Sand Bay	commissioned by the Coastal Erosion Committee, 1907	documents only	low
D/RA/9/24	18th century	bundle of copies of maps	includes copy of 16th century map and other 18th century maps		medium
D/RA/1/1/19	19th century	Tide Basin in the River Parrett	detailed plan of locks, docks etc on Bridgewater and Taunton Canal Navigation	not in study area	low
D/RA/1/2/124	19th century	Survey of the Yatton Jury of Sewerers	list of people responsible for maintenance of sea wall in Yatton, Brockley, Chelvey, Backwell, Kingston Seymour and Kenn	documents only	low
DD/WO	1802	Map of St Decuman's	Bristol Channel at N of map		low
DD/X/LTR1	1687	East Quantoxhead	Copy of map. Shows boat on river	poor quality reproduction	low
DD/X/WBB	1815	Uphill	Shows public wharf at end of "The Pill"		low

D/RA/2/9/10	early 20th century	bundle of maps, plans and surveys	erosion at Steart 1902, 1922 and 1928	good quality drawings	medium
DD/PT	1780	Kenn and area	shows feature labelled "west wharfe wall to keep back the spring tides"	good , early drawings	medium
DD/SAS H/528/1	19th century	Sea defences at Dunster	plan and section of wooden pile sea defences		medium
UKHO					
804	1815		survey of channel to Gloucester	no archaeological detail	low
Sailing directions	1839	Sailing Directions for the Bristol Channel	descriptions of charts surveyed by Commander Denham and Captain Beechly		
L4505	1845		re-survey of the Severn by Beechly	no archaeological detail	low
L7314	1847	Rough of the Bristol Channel	Clevedon to Aust surveyed by Beechly		low
L7315	1849	Survey of the Bristol Channel by Beechly	see MA19/42 in GRO		high
L7316	1849	Severn to Tewkesbury	surveyed by Beechly		low
L9785	1853	Original Rough of the Port of Bridgewater	survey by Alldridge. Shows submerged forest off Stolford, fishing weirs etc		medium
E9629	1953	Flatholm to Portishead		no archaeological detail	low
K3647	1962	Avonmouth to Sharpness	soundings only	no archaeological detail	low
H1430/72	1971	Portishead foreshore	soundings off Portishead	no archaeological detail	low

E143/2	19th century		shows warren house at Steart and Steart Point as 3 islands	otherwise poor on archaeological detail	low
E143/3	19th century				low
B4435			soundings in the middle of the channel	no archaeological detail	low
L7313			surveyed by Beechly	no archaeological detail	low