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Cornwall and Isles of Scilly Mapping Project

ENGLISH HERITAGE HEEP PROJECT 2710

A Report for The National Mapping Programme

Historic Environment Service (Projects)

Cornwall County Council

Cornwall and Isles of Scilly Mapping Project
English Heritage HEEP Project 2710

Management Report

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Cover illustration

Tregonning Hill, Breage. There has been intensive human activity here for at least two and a half thousand years. An Iron Age hillfort sits on the summit; more recently the slopes were worked for tin and china clay. Photo © Cornwall County Council Historic Environment Service

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Abbreviations

AMIE	Archives and Monuments In England
CAU	Cornwall Archaeological Unit
CCC	Cornwall County Council
CUCAP/ULM	Cambridge University Committee for Aerial Photography
DTM	Digital Terrain Model
EH	English Heritage
ESA	Environmentally Sensitive Area
GIS	Geographical Information System
HER	Cornwall and the Isles of Scilly Historic Environment Record
HES	Cornwall County Council Historic Environment Service
HLC	Historic Landscape Character
NMP	National Mapping Programme
NMR	National Monuments Record
NMRC	National Monument Record Centre
OS	Ordnance Survey
RAF	Royal Air Force
RCHME	Royal Commission on the Historical Monuments of England
RCZA	Rapid Coastal Zone Assessment
WHS	World Heritage Site

1 Summary

This report has two aims. The first is to document and review the running of the Cornwall and Isles of Scilly Mapping Project and to highlight its main achievements. This will assist the planning of future projects. The second is to provide a comprehensive guide to the methodology used, the sources consulted, and the quality and quantity of data produced. This will provide essential information for the benefit of end users of the archaeological data.

The Cornwall and Isles of Scilly Mapping Project is an external project of the National Mapping Programme (NMP). It was funded by English Heritage (and formerly by the Royal Commission on the Historical Monuments of England). The project was carried out by the Historic Environment Service of Cornwall County Council (formerly the Cornwall Archaeological Unit). Work began in January 1994 and the mapping phase was completed in September 2006.

The project area comprises the whole of the county of Cornwall and the Isles of Scilly. This amounts to 202 OS 1:10,000 quarter map sheets. Part of Devon overlaps in 16 of these map sheets and was included in the project area.

Over the course of its 12 year lifetime the project has produced a huge amount of data. This, in tandem with technological developments during this time, has completely transformed not only the amount of available information about Cornwall's archaeology visible on aerial photographs, but also the way in which it can be accessed.

As a result of the project, coupled with the use of GIS, whole historic and prehistoric landscapes have been mapped and can be viewed in their entirety.

Roughly 30,000 archaeological features were mapped and recorded in the project Morph2 database. More than 24,000 monument records in the Cornwall and Isles of Scilly Historic Environment Record (HER) were either created or enhanced by data from the project. Seventy five percent of the sites identified during the project are new to the HER and 85% are new to the National Monuments Record.

One key outcome of the project is the significant enhancement of our knowledge of the nature and extent of the archaeological resource in lowland Cornwall.

A second key outcome is the mapping of previously unsurveyed monument-rich upland landscapes such as the Lizard peninsula.

Of particular significance are the identification of more than 2,000 new enclosures from the late prehistoric or Romano-British period, the detailed mapping of Cornwall's extensive mining remains (in particular many previously unsurveyed tin streamworks), and the recording of numerous defensive and military features from the Second World War.

The project has provided key data for a number of large scale management and resource projects, of which the most notable is the Cornwall and west Devon Mining Landscape World Heritage Site bid project.

Data from the project informs strategic and individual planning decisions and facilitates decisions regarding the management, preservation and research of archaeological sites and historic landscapes in Cornwall and the Isles of Scilly.

Two directions for future research are suggested: firstly a reappraisal of the late prehistoric and Romano-British settlement pattern in lowland Cornwall, secondly detailed analysis of enclosures to identify more examples of site types which are rare in Cornwall or were absent from the county record prior to the project.

Dissemination of interim results and progress reports has taken place on a regular basis over the course of the project. The main dissemination of project results

comprises a popular website, *flyingpast.org*, and two journal articles to be published in *Cornish Archaeology.*

The aim of the project was in line with the aim of the NMP nationally: *'to enhance our understanding about past human settlement, by providing information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from the Neolithic period to the twentieth century'* (Bewley, 2001, 78).

To achieve this all archaeological sites identified on aerial photography in Cornwall and the Isles of Scilly were mapped and interpreted to a consistent standard, and the resulting information was incorporated into the county Historic Environment Record and National Monument Record databases

Within the project area there had been a limited amount of aerial photograph transcription of varying quality prior to NMP. The project built on this by plotting all sites to a high degree of accuracy and by bringing together information from a wide range of photographs into a coherent whole.

More than 50,000 aerial photographs were consulted during the project. These photographs are housed in three main collections: at the National Monuments Record Centre, Cornwall County Council, and Cambridge University.

The archaeological scope of the project, in line with NMP projects nationally, included all archaeological features from the Neolithic to 1945 visible on aerial photographs. The project developed a policy of mapping industrial archaeological remains in as much detail as practical. This represented a departure from previous NMP projects in which industrial archaeology was mapped schematically.

The NMP mapping of the whole of Cornwall and the Isles of Scilly should be regarded as an outstanding achievement. However, the size of the project and length of time taken for completion made effective management problematic and resulted in inherent inconsistencies within the project outcome.

Project methodology evolved over the course of the project, and was updated twice. The most important development was the change from manual to digital mapping which took place in 1998. Whilst improving the end product, developments to methodology had timetable implications in that digital transcription took significantly longer than manual techniques.

The project area was initially subdivided into a series of manageable blocks of landscape which were to be mapped one after the other. The numerical sequence of blocks was dictated by the mapping priorities at the time. During the course of the project the composition of these blocks and the sequence in which they were mapped was amended on a number of occasions to reflect changes in mapping priorities.

Initially the project team comprised one interpreter. From late 1998 there were two interpreters, and a third interpreter joined the team in 2001 as a result of NMP acceleration. Within this framework there was continuity of personnel throughout the lifetime of the project.

Transcription took significantly longer than anticipated in the original project design; 19.5 days per quarter map sheet rather than the estimated 6.5 days. The original project timetable was underestimated for a number of reasons. Developments in methodology added to the timetable. Further unavoidable delays to the project end date arose owing to staff absence and periods of part-time working. Another factor was suspension of work on the project on three occasions: once because of funding problems, and twice while the team carried out other NMP projects. As a result of timetable alterations there were three revisions to the original project design and three variations to the project.

Because of technological developments over the course of the project not all the mapping was produced digitally.

Items relating to the project are deposited in the archive at the National Monuments Record Centre in Swindon and at the office of the Historic Environment Service of Cornwall County Council, Truro.

2 Introduction

2.1 Background to the project

The Cornwall and Isles of Scilly Mapping Project is part of the National Mapping Programme (NMP). The NMP was initiated by the Royal Commission on the Historical Monuments of England (RCHME) in 1992. Since the merger of RCHME and English Heritage (EH) in 1999, the project has been run and funded by EH.

The aim of the NMP is 'to enhance our understanding about past human settlement, by providing information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from the Neolithic period to the twentieth century' (Bewley, 2001, 78). To achieve this aim a methodology was developed from previous selective approaches to mapping from aerial photographs (e.g. Benson and Miles, 1974, Palmer 1984). The guiding principle of this methodology is 'to map, describe and classify all archaeological sites recorded by aerial photography in England to a consistent standard' (RCHME, 1995).

NMP projects are conducted either by the Aerial Survey section of EH, or by external organisations. The Cornwall project is an external NMP project and the work was carried out by the Historic Environment Service of Cornwall County Council (HES, formerly Cornwall Archaeological Unit [CAU]). The Cornwall project it is one of a number of large, county-based external NMP projects established in the early 1990s (the others being Essex, Nottinghamshire and Northamptonshire) and work on the project began in January 1994.

Initially the project was funded by RCHME through half-yearly or quarterly grants. Following the merger of 1999, a contract was drawn up between EH and Cornwall County Council (CCC) which secured funding to completion of the project and this has taken the form of a series of stage payments.

2.2 Reasons for and circumstance of the project

In comparison with the upland areas of the county (where there is good survival of relict landscapes) the archaeological resource of lowland Cornwall was poorly understood prior to the project. Lowland areas are subject to continued threats from ploughing and development and it was seen as a priority to redress this imbalance.

Previous landscape survey in Cornwall had focussed largely on Bodmin Moor and West Penwith and there was a perceived need for systematic survey of other monument-rich upland areas such as the Lizard Peninsula and Hensbarrow.

Programmes of aerial reconnaissance carried out by the RCHME in the early 1980s and by Cornwall Archaeological Unit (funded by the RCHME and EH) since 1984, had identified a substantial number of plough-levelled sites in lowland Cornwall (Young, 1995B). This work included the integration of the survey results into the Cornwall Historic Environment Record (HER) and sketch plotting of the sites onto HER base maps.

There had been no programme of consultation of the large number of vertical photographs of the county held in various collections. It was considered likely that these would contain a large amount of hitherto untapped archaeological information.

For these reasons, the NMP project was established to enable systematic plotting of all sites to a consistent and accurate level and to bring together information from a wide range of aerial photographs into a coherent whole. The aim was to provide the HER and National Monuments Record (NMR) with a comprehensive database of archaeological information recorded from aerial photographs. This information would build upon and consolidate work previously undertaken in the county, and would identify areas for further research.

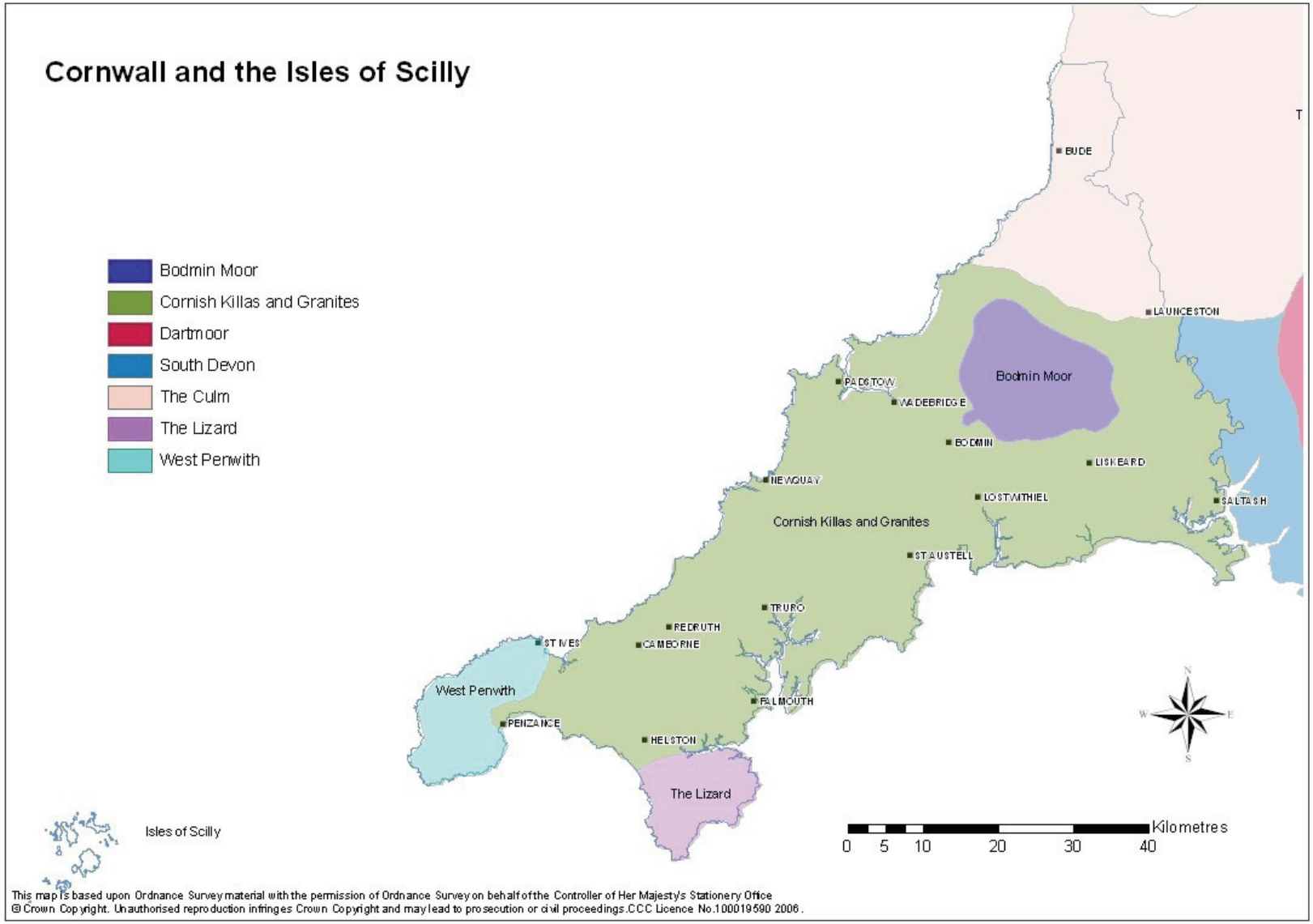
2.3 Products and archive deposition

Items relating to the project are deposited in the archive at the National Monuments Record Centre (NMRC), Kemble Drive, Swindon SN2 2GZ and at the office of the Historic Environment Service, Cornwall County Council, Kennall Building, Old County Hall, Station Road, Truro TR1 3AY. A full account of the project archive is presented in section 13 of this report.

2.4 Data exchange

Data exchange between CCC and EH was carried out informally during the course of the project. Information resulting from the mapping was incorporated into the Cornwall and Isles of Scilly HER, and copies of the NMP maps and site record data were sent to the NMRC. Integration of the monument records is, at the date of this report, outstanding.

Figure 1. *Cornwall and the Isles of Scilly*



3 The project area

3.1 Description of the project area

Cornwall is a long, narrow peninsula measuring roughly 110km east to west (Figure 1). The county boundary with Devon in the east runs for approximately 70km along the line of the river Tamar. The Isles of Scilly lie 40km west-south-west of Land's End and consist of five inhabited islands (the largest of which, St Mary's, covers only 4km x 3.5km) and numerous smaller, uninhabited islands.

The land mass of Cornwall and the Isles of Scilly totals approximately 3,800 square kilometres, and is covered by 202 OS 1:10,000 quarter map sheets. Eighty five of these quarter map sheets have a percentage of their area in the sea. Sixteen map sheets overlap with west Devon and the parts of Devon included on these sheets were treated as being within the project area and were mapped.

The most obvious feature of the project area is its extensive coastline, which measures approximately 450km in length. The Atlantic coasts of north Cornwall, Land's End and the west side of the Lizard Peninsula are characterised by dramatic cliffs, whereas the Channel coasts of the south and southeast are more gentle in comparison. Along parts of the coast (particularly the south coast) river estuaries are characterised by finger-like inlets, and in some places the meandering tributaries have become silted up as a result of deposits of alluvium and waste washed down from mine workings further upstream (e.g. Restronguet creek in the Fal estuary).

The landscape of Cornwall and the Isles of Scilly is predominantly rural in character, and supports a mixed farming regime. Agriculture takes up 86% of the land in the project area and the farming landscape is characterised by a patchwork of small fields, many of them resulting from the enclosure of open field systems in the late medieval and early post medieval periods. There are areas of unenclosed moorland; the most extensive occur on the Bodmin Moor uplands, but there are smaller areas on the Lizard Peninsula, in West Penwith, and elsewhere. There is only a limited amount of woodland, largely confined to the river valleys, but with some forestry plantations in the north and northeast of Cornwall

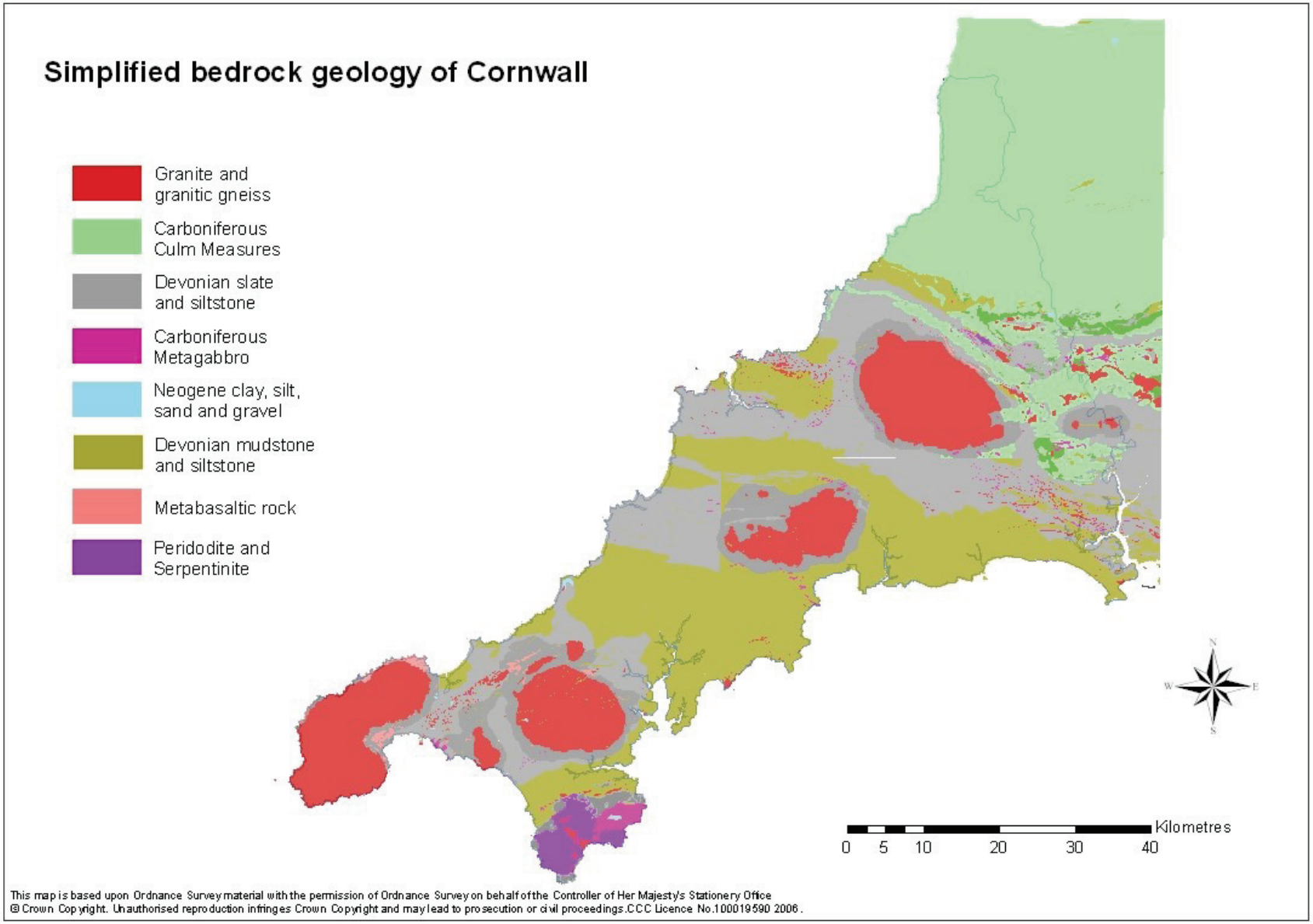
The population of 500,000 is housed largely in a dispersed network of farms, hamlets, villages and small towns. Truro is the only city and is the administrative centre of the county. The conurbation of Redruth and Camborne forms the largest settlement with a population of roughly 47,000 (these figures are provided by the CCC Spatial Planning Department). The Isles of Scilly support a population of 2,500 with the only town of any significance being Hugh Town on St Mary's.

After farming, the most important industry is tourism. This makes some claims on land, particularly in coastal areas, for amenity purposes (caravan parks, holiday complexes and such like), and has led to the post-war expansion of resort towns such as Newquay.

China clay extraction is the only major manufacturing industry, and is focussed on the area to the north and west of St Austell in central Cornwall. This industry has had a significantly adverse impact on the archaeological landscape that preceded it.

Historically the tin and copper mining industries have made substantial claims on land but although Cornwall was one of the leading regions of early industrialisation, it was also one of the first societies in Britain to de-industrialise. At the outset of the project only one tin mine was in operation (South Crofty, near Camborne) but in the intervening years this mine has ceased operations. The legacy of mineral extraction is derelict land concentrated in the areas of granite (Figure 2). The implications for aerial survey are that in those areas, notwithstanding the fact that the remains of the tin and

Figure 2. *Simplified bedrock geology of Cornwall*.



copper industries are in themselves archaeologically significant, an unknown number of earlier sites have been destroyed by mining activity.

In the Isles of Scilly tourism is the mainstay of the economy. The flower growing industry, which began in the late nineteenth century, has had an impact on the landscape of Scilly (as well as parts of south west Cornwall) with its characteristic pattern of small fields sheltered by tall hedges.

3.2 Geology of the project area

The study area is dominated by a spine of granite bosses (Figure 2). The five main ones are Bodmin Moor, Hensbarrow, Carnmenellis, West Penwith, and the Isles of Scilly. Lesser granite intrusions occur at Tregonning Hill, Carn Brea and Carn Marth in the west, and Kit Hill and Hingston Down in the east. Associated with the granite bosses are extensive areas of metamorphic aureole – surrounding rocks which have been altered by the heat of the intruding granite. Mineralization occurred during the cooling of the granite and metamorphic aureole, resulting in the intrusion of tin and copper in lodes (seams) running east–west, and lead, zinc and iron in lodes running north–south. At a later stage some granites were altered, the most widespread instance being the formation of Kaolinite (china clay) which is found most extensively on the Hensbarrow granite.

Away from the granite areas the surface geology of Cornwall comprises three main elements. The oldest rocks in the county, likely to be Pre-Cambrian in origin, are found on the Lizard peninsula. Most of these rocks have undergone subsequent metamorphosis and the Lizard Complex is a nationally important mass of intrusions, most notably serpentine, gneiss, schists and some granite.

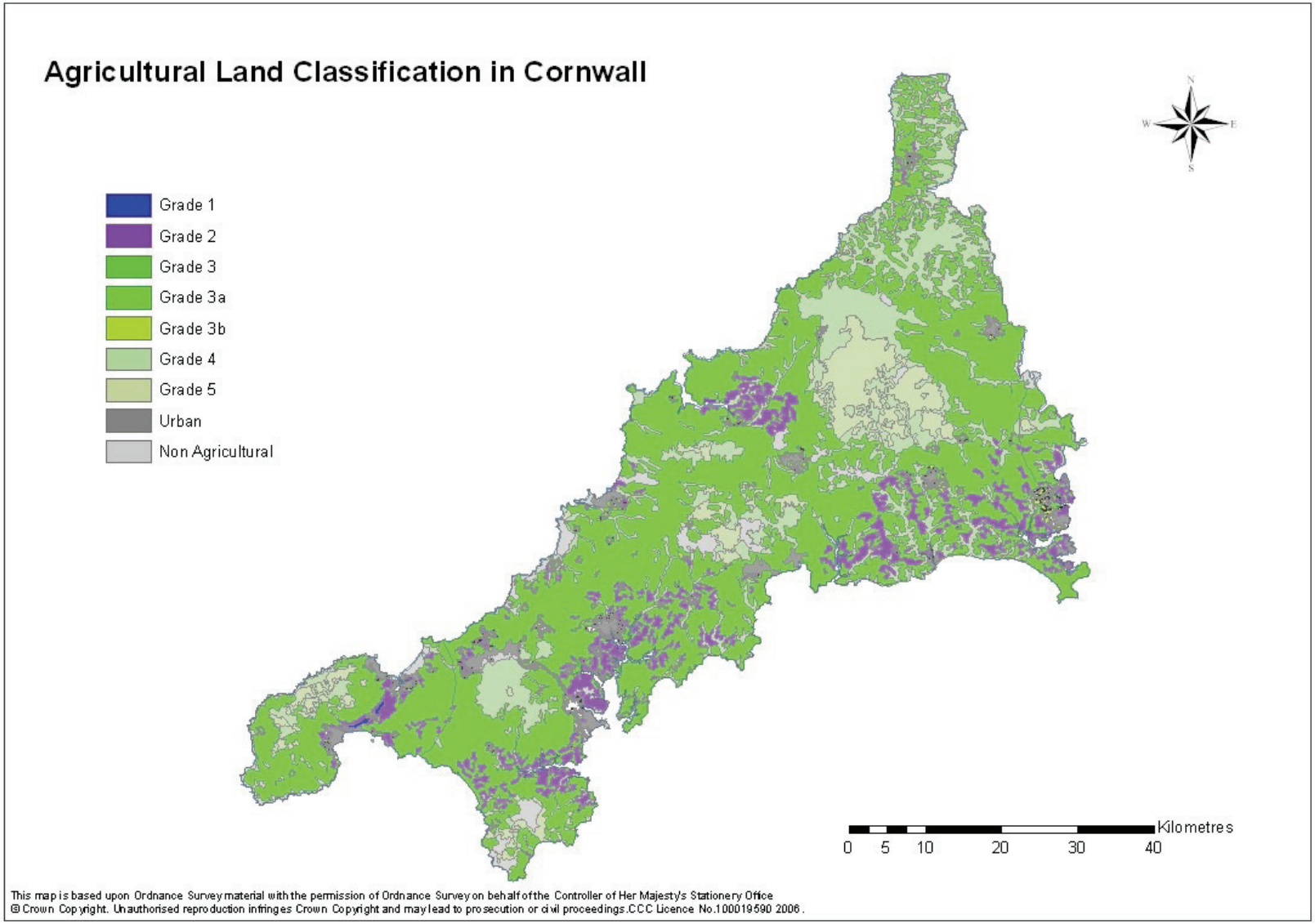
In the far northeast of the county are Carboniferous rocks forming the western edge of the Culm Measures which characterise extensive areas of west Devon. These deposits contain black shales, sandstones and thin limestones.

The underlying geology of most of Cornwall, however, consists of Devonian rocks. There are slight variations between the Lower, Middle and Upper Devonian beds, but generally these Killas, as they are known, are characterised by clays, shale, slates, siltstones and sandstones.

During Pleistocene times the project area was in a periglacial zone subject to freeze/thaw processes. In the post-glacial period Cornwall has been subjected to sea level rise, resulting in a coast of submergence. Extreme low tides expose submerged forests at several localities (e.g. Mount's Bay) and submerged prehistoric fields (e.g. on the sand flats in the Isles of Scilly). Rias, or drowned rivers, are another feature of the submerged coastline (e.g. the rivers Fal, Fowey and Helford).

3.3 Soils in the project area

Figure 3. *Agricultural land classification in Cornwall*.



Much of Cornwall is covered by poor soils and most of the agricultural land is classed as Grade 3 in the Agricultural Land Classification of England and Wales, 1972 (Figure 3). The only extensive areas of Grade 2 arable land are around the Camel estuary, in the southeast around St Germans, and around the Fal and Helford estuaries. The only soils classed as Grade 1 occur in a small pocket along the Hayle River.

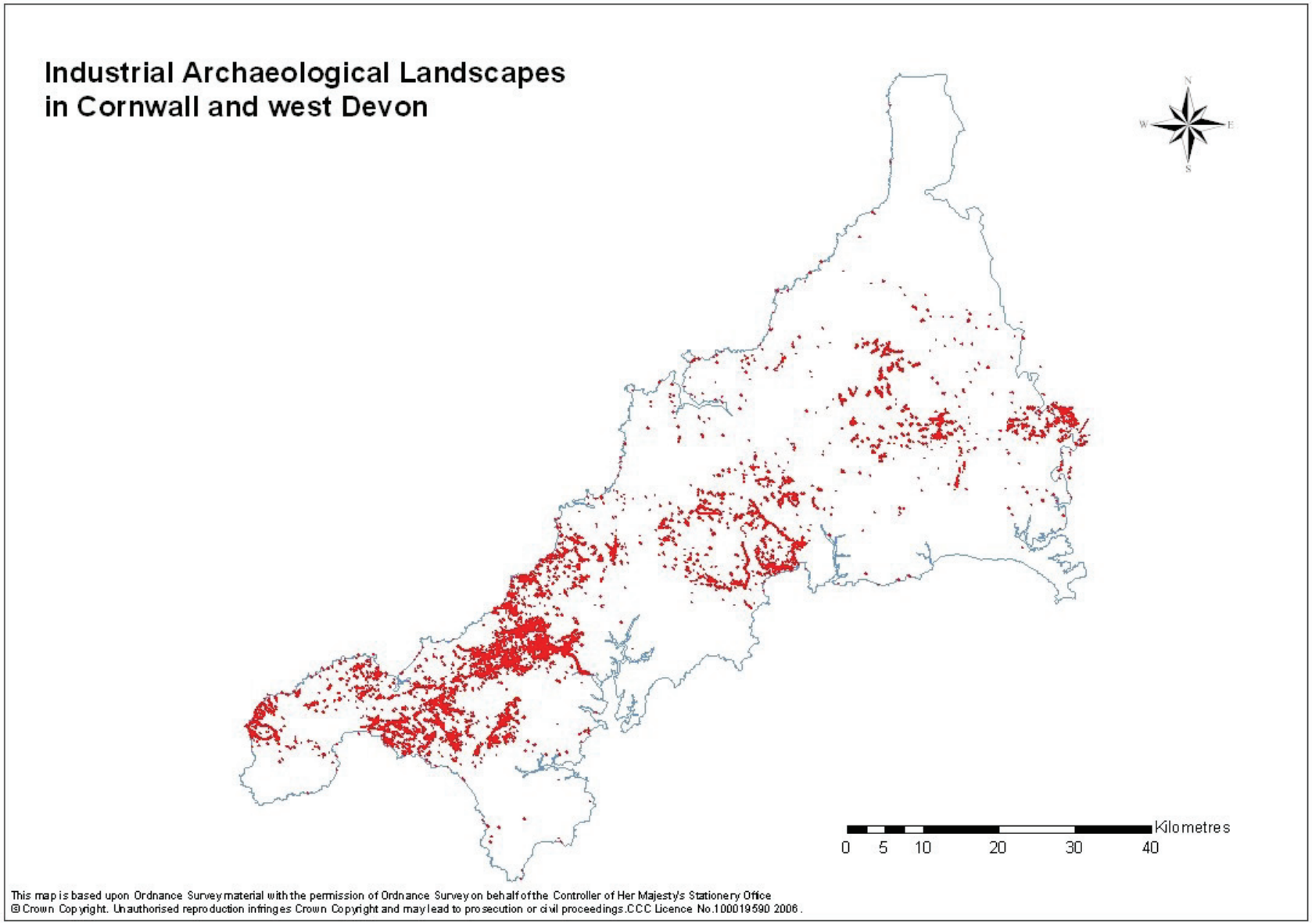
A summary of the soil types in Cornwall and the Isles of Scilly is shown on maps produced by the Soil Survey of England and Wales, 1974. The project area is covered predominantly by brown earths associated with stagnogley soils, brown podzolic soils and rankers. The Devonian Killas, covering most of the county, yield a clayey loam with impeded drainage in the east, less so to the west of Truro. Much of the Lizard peninsula is characterised by loamy soils with a wet, peaty surface over a thin iron pan. In the northeast the Culm Measures yield wet, clayey soils.

Raw peat soils occur at the highest points on the granite, most notably on Bodmin Moor and the Hensbarrow uplands.

Raw sands occur locally at Hayle, Perranporth and Padstow and are the result of sand being blown inland to form extensive dunes known locally as Towans. Wind-blown sands also occur in the lower lying areas of the Isles of Scilly giving sandy, friable soils which are well drained but very shallow.

3.4 Archaeology of the project area

Figure 4. *The industrial archaeological landscape in Cornwall*



Cornwall and the Isles of Scilly have a rich and varied archaeological heritage. The county Historic Environment Record (HER) is one of the largest in the country and, prior to the project, contained 30,000 monument records (this figure does not include records for the site type 'artefact'). Cornwall is relatively removed from intensive agricultural development and in many parts of the county stone has been used for building since prehistory. As a result above-ground traces survive in a high proportion of the monuments recorded in the HER. This is reflected by the unusually high number of sites – almost 2,000 - designated as Scheduled Monuments.

The most visually evident elements of Cornwall's archaeological heritage are the remains of the eighteenth and nineteenth century tin and copper mining industries (Figure 4). The disused workings of these industries survive in great numbers in the granite areas of the county; so much so that the ruined engine house has become an evocative and iconic symbol of Cornwall. During the course of the project the international importance of the mining landscape was recognised by its designation as a World Heritage Site.

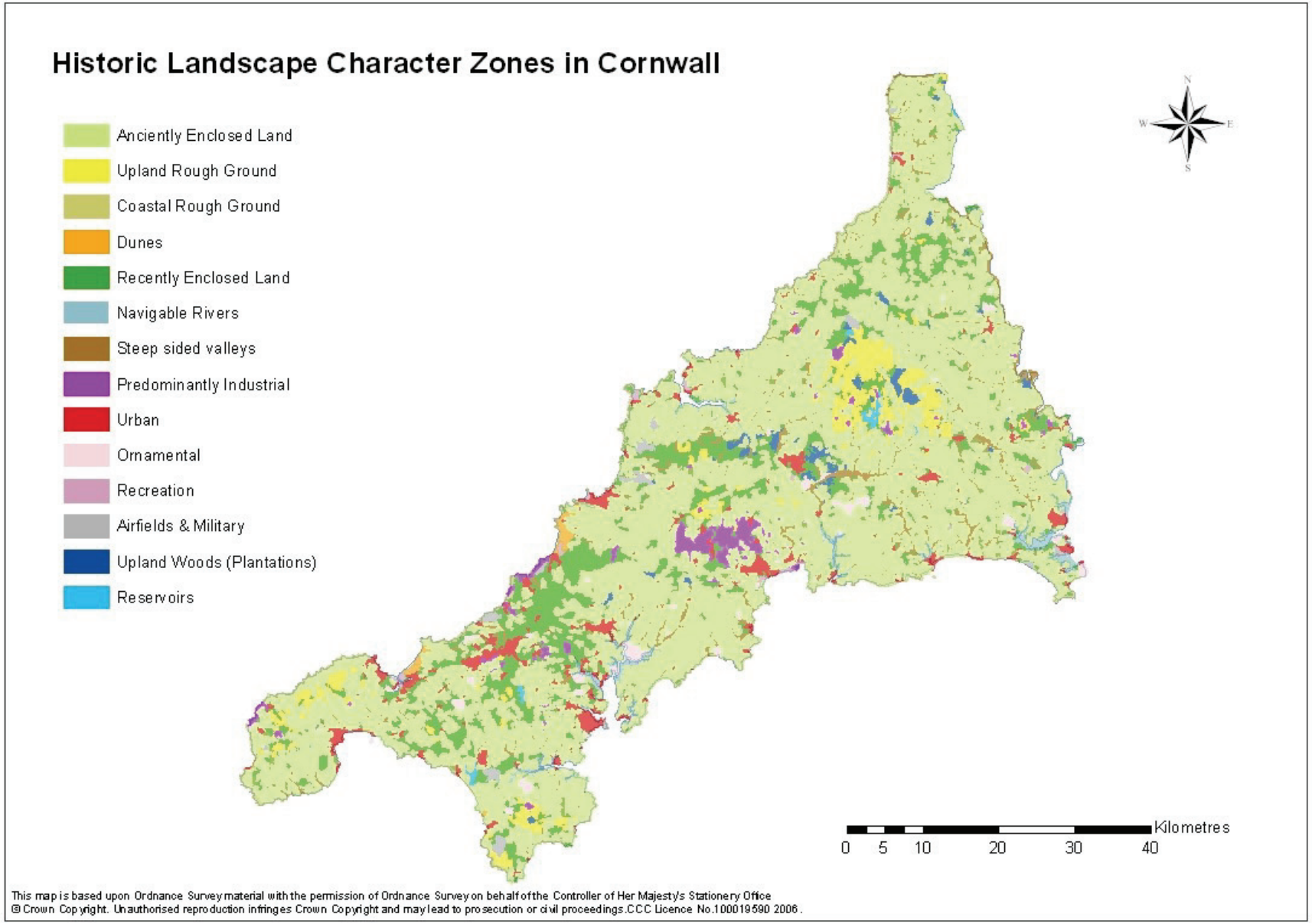
The granite massif of Bodmin Moor is of enormous archaeological significance nationally. Extensive relict landscapes encompassing prehistoric settlements and fields, ceremonial and burial sites, medieval farms, and early tin workings all survive here. In Scilly, West Penwith and in parts of the Lizard peninsula there are similarly extensive remains.

In lowland Cornwall the prehistoric and historic farming (and settlement) heartland can be identified through Historic Landscape Characterisation (HLC) (Clark et al, 2004). Areas classified in Cornwall's HLC as *Anciently Enclosed Land* (Figure 5) contain numerous farms and hamlets first mentioned in early documents such as the Domesday Book or whose medieval or pre-medieval origins are inferred from place-name evidence (Herring, 1998). Some of these early settlements are set within a pattern of small, irregular fields which are likely to perpetuate the pre-medieval field pattern. Throughout much of Cornwall, however, the present day field layout clearly derives from the enclosure of medieval open field systems, where groups of strips have been parcelled up by later enclosure. These fields are characterised by the generally sinuous nature of their boundaries (Herring, 1998).

Anciently Enclosed Land is the farming heartland; it is land which was first cleared and used for growing crops and grazing cattle since the later Bronze Age. Being the ancient farmland, it is also the principal zone of ancient settlement. Of course many centuries of agriculture, including wholesale re-organisations of the layout of fields has obscured and denuded many earlier features and the above-ground survival of archaeological monuments does not compare with that in the granite uplands. At many locations, however, the earth and stone ramparts of late prehistoric or Romano-British enclosed settlements (locally known as 'rounds') have been re-used as field banks and incorporated into the present day field pattern. Elsewhere the below-ground remains of prehistoric settlement features have been identified through evaluations, watching briefs, geophysical survey or excavation in advance of development (e.g. Nowakowski, 1991, Quinnell, 2004) and as cropmarks on aerial photographs (section 4.1.3).

Areas classified as *Recently Enclosed Land* in Cornwall's HLC (Figure 5) are characterised by regular field patterns consisting of rectilinear fields with straight, surveyed boundaries. These fields result mainly from the enclosure of former rough ground during the post medieval period, often in the nineteenth century. In the main the archaeological resource of *Recently Enclosed Land* is less rich than that of *Anciently Enclosed Land*, with few settlement features, although it can contain important monuments such as Bronze Age barrows and extensive mining remains (Herring, 1998).

Figure 5. *Historic Landscape Character zones in Cornwall*



In the project design (Young, 1995A), the average number of HER records for sites per OS quarter map sheet prior to the project was calculated as 143 but the distribution of sites was not even throughout the project area. Quarter map sheets covering those areas containing extensive relict landscapes and those covering the mining districts of Cornwall contained large numbers of site records. The three areas with highest site densities were Bodmin Moor, West Penwith and the Isles of Scilly. These areas, particularly Bodmin Moor and West Penwith, have all been subject to detailed and extensive archaeological survey.

The St Austell mining district also contained particularly high numbers of site records. These records relate not only to the mining industry but also to the nineteenth and twentieth century china clay industry which is focussed on this area.

4 Previous transcription in the project area

4.1 Previous transcription work

Aerial reconnaissance for archaeological purposes in Cornwall and the Isles of Scilly prior to the project was carried out by three organisations.

- Cambridge University (CUCAP/ULM). Flights have been made at irregular intervals since 1948. Copies of selected photographs are held by HES
- NMR. Flights have been made at irregular intervals since 1975. Copies of selected photographs are held by HES
- HES. Flights (funded by RCHME and EH) have been made at regular intervals since 1984. All photographs resulting from these flights are held by HES.

Prior to the project a limited amount of transcription had been carried out in the project area.

4.1.1 Transcription of selected enclosures

In 1982 a major journal article on Cornish enclosures was published (Johnson and Rose, 1982). This article included illustrations of nearly 300 enclosures, including hillforts, cliff castles, Neolithic tor enclosures, and a range of rounds. These illustrations included some manual transcription from aerial photographs available at the time using a mobius network. These transcriptions comprise a series of 1:2500 ink drawings on opaque film and are held on file by HES.

4.1.2 Bodmin Moor Survey

This survey, carried out jointly by RCHME and CAU between 1980 and 1985, was one of the first projects nationally to combine aerial survey with follow-up field survey and, as such, was a ground-breaking initiative. The results are contained in two separate publications (Johnson and Rose, 1994, and Herring, Sharp and Smith, forthcoming).

A specially commissioned vertical aerial survey of Bodmin Moor was carried out, at a scale of 1:7500, by Cambridge University Committee for Aerial Photography (CUCAP/ULM) in 1977. Archaeological sites visible on this photography were transcribed by RCHME staff using a Thompson Watts stereo plotting instrument at a scale of 1:2,500. Further detail was provided by a programme of oblique photography carried out by RCHME. The resulting plots from this mapping were then taken into the field by the survey team and amended where necessary. These transcriptions comprise a series of pencil drawings (including colour-coded field amendments) on translucent 1:2500 map overlays.

During the Bodmin Moor Survey, industrial remains visible on the photographs were not plotted in detail but their extent was indicated. At a later date, CCC staff sketch plotted these remains in more detail. These transcriptions comprise a series of ink drawings on translucent 1:2500 map overlays.

During the course of the NMP project all the overlay drawings from the Bodmin Moor Survey were scanned and incorporated into the HES GIS as a Raster layer.

Although the Bodmin Moor Survey plots form a high quality dataset, the survey was to some extent selective. Firstly, only areas of moorland were surveyed and not the surrounding farmland. Secondly, only photographs from the two sources mentioned above were consulted. As a result there were gaps in the archaeology recorded in areas that had been taken into agriculture during the post war years but prior to 1977 when the aerial survey was commissioned.

4.1.3 Local reconnaissance

Programmes of aerial reconnaissance in Cornwall began in 1948 are still ongoing; at the start of the project these programmes had produced more than 5,000 black and white specialist oblique photographs and a similar number of colour slides.

Results of the reconnaissance programmes were rapidly assimilated into the HER through sketch plotting of new discoveries and the addition of relevant data to the HER database. These transcriptions comprise a series of pencil drawings made directly onto 1:10,000 HER base maps or onto translucent 1:10,000 HER map overlays.

4.2 The use of previous transcription work

The main use of previous transcription work during the project involved the transcriptions from the Bodmin Moor Survey. The RCHME transcriptions were produced in a systematic and consistent way with a high degree of skill and to a high level of accuracy. Therefore they were digitised as part of the NMP mapping of the Bodmin Moor Survey area. Additional information from the wide range of photographs newly available to the project was added to the digital transcriptions.

Sketch plots of industrial features in the Bodmin Moor Survey area were used at two levels. Initially these transcriptions were consulted as a guide to interpretation of individual features; the features themselves were plotted anew using NMP methodology (Appendix 1). Towards the end of the project, insufficient resources were available to sustain this detailed level of mapping, and the transcriptions were used as the basis for NMP mapping.

The 1:2500 ink transcriptions of selected enclosures were consulted during the project as a guide to interpretation, but the enclosures were plotted anew using NMP methodology.

Appraisal of the 1:10,000 sketch plots from the reconnaissance programme concluded that the data produced contained inconsistent errors in size, form, and accurate positioning. Therefore they were not consulted during the project.

5 Aims and objectives

The aim of the project is consistent with the fundamental aim of the NMP nationally.

'to enhance our understanding about past human settlement, by providing information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from the Neolithic period to the twentieth century' (Bewley, 2001, 78).

To achieve this aim there were three principal objectives.

1. To map and interpret all archaeological sites recorded by aerial photography in Cornwall and the Isles of Scilly to a consistent standard.
2. To describe all archaeological sites mapped during the project and incorporate this information into the county HER and NMR databases.
3. To disseminate the results of the project.

To achieve these objectives the project comprised four distinct stages.

1. Collation, interpretation and recording of aerial photographic data.
2. Preparation of a Management Report on this data.
3. Assessment of the value of the data and its potential for publication and for future research.
4. Preparation and delivery of publication of the project results.

The first phase was completed in September 2006; this report constitutes the second stage; proposals for both popular and academic publication of the results were submitted in July 2006. At the time of writing the popular element of the publication – an interactive website (flyingpast.org) – is about to go on line; a short article summarising the project and an academic article examining the prehistoric enclosures in the Camel Estuary area are currently being produced. Both articles will be published in *Cornish Archaeology*, the annual journal of the Cornwall Archaeological Society.

6 Archaeological scope of the project

6.1 Broad archaeological scope

The archaeological scope of the project as defined in the project design (Young 1995A, section 4) was based on guidelines current at that time (RCHME, 1995). During the course of the project there have been a number of refinements to the overall archaeological scope of NMP projects and current details are available in a draft document (EH forthcoming).

The refinements made to the archaeological scope of the NMP were adopted by the project as they were introduced. Taking this into account, the general sphere of interest of the project can be summarised as follows.

- All visible archaeological features (including probable and possible features), dating from the Neolithic to the twentieth century (pre-1946), were recorded.
- This includes both plough-levelled sites and those with upstanding remains, regardless of whether they had been previously surveyed.
- Previously surveyed sites (those, for instance, appearing on OS maps) which have not been photographed or which are completely obscured by vegetation were not recorded.
- Features still in use or fossilized by later structures that are still in use (e.g. buildings, field hedges, canals and railways) were not recorded.

6.2 Project-specific issues

A number of project-specific issues necessitated refinement of the archaeological scope. These issues relate to industrial remains and the appropriate level of detail to which they might best be recorded. The archaeological scope of this project differs from that of some NMP projects with regard to three types of industrial features.

6.2.1 Mining

Cornwall has a particularly rich industrial heritage, characterised by extensive remains of tin and copper mining, by associated industries such as arsenic and wolfram extraction, and by a small number of iron, lead, and silver mines (Figure 4). In 1994 the only other NMP project which had recorded significant amounts of industrial archaeology was the Yorkshire Dales Project (Horne and MacLeod, 1995).

Initially the recording strategy used for the Yorkshire Dales was adopted. Features appearing on OS maps (including engine houses, chimneys, tramways, and major shafts) were not mapped but were mentioned in the project database. Unmapped features were transcribed and recorded; typically these comprised spoil tips and small tinners pits (the equivalent of the Yorkshire Dales ‘bell pits’ or ‘short shafts’ [Horne and MacLeod, 1995]). These features were mapped schematically using an asterix convention. Tinners pits (and bell pits) tend to run in lines following the mineral seams and the aim of this mapping technique was to indicate the general trend and extent of the pits rather than religiously plot each individual feature. The perceived extent of each mine was then indicated by a dashed outline.

It soon became apparent that, although this approach had worked well in the Yorkshire Dales, it was failing to provide an adequate record of the industrial remains in Cornwall.

There were four main reasons.

1. HES undertake numerous assessments, watching briefs and surveys of abandoned mines. NMP mapping of mining remains was not producing sufficiently detailed plots to be of value to this work and this was seen as a priority issue to be addressed before the mapping of West Penwith (an area rich in industrial archaeology) in1997.
2. In mining areas, industrial remains are the overwhelmingly predominant feature of the historic environment and the full scale of their impact on the landscape was not being sufficiently well represented by the selective, schematic approach.
3. Whilst the extent of the Yorkshire dales lead mines can be interpreted relatively clearly, Cornish tin and copper mines frequently form dense complexes consisting of a number of different mines and covering many hectares; it is often difficult or impossible to define the extent of each individual mine.
4. Mining features frequently occur adjacent to or cutting through other archaeological features (such as field systems, prehistoric settlements, even hillforts) and the dashed lines used to define extent were being misinterpreted as archaeological features by end-users.

To resolve these issues a revised strategy was adopted. The schematic mapping of tinners pits was abandoned; instead they were drawn as seen. In the most complex sites, where there are hundreds of pits, some degree of standardised convention was used in order to sustain the pace of the mapping. In these instances the position of each pit in the landscape was mapped accurately but the precise size and shape of individual pits was approximated.

All visible individual features (including buildings, chimneys, and other features appearing on OS maps) were plotted to as high a level of detail as was practical.

The revised strategy also involved dispensing with the standard NMP convention of the dashed line ‘extent of area’ because this was proving at best meaningless; at worst misleading in the Cornish context.

6.2.2 China clay extraction

The china clay and associated china stone industries are centred on the Hensbarrow granite in the St Austell area (Figure 2). These are essentially late nineteenth and twentieth century industries which are still ongoing today.

China clay extraction has had a huge impact on the landscape, radically transforming large swathes of the countryside. Disused china clay workings cover very extensive areas; they are frequently intermingled with early tin streamworking and mining remains to form uninterrupted, multi-phase industrial complexes.

Relic features associated with the industry appear on the First and Second Edition OS maps of 1880 and 1907 and on the six-inch series maps of 1963. Because this has been a fast-expanding industry, many post-1907 remains had been destroyed by the time of the 1963 mapping and are not recorded on any OS map.

These features are, however, visible on 1940s and 1950s RAF vertical photography. The same mapping strategy adopted for mining sites was used in transcribing and recording the remains of the china clay industry. As a result, detailed NMP mapping from these photographs has enabled the historic development of the early twentieth century china clay industry to be recorded in a meaningful way.

6.2.3 Quarries

At the start of the project quarries smaller than 1,000 square metres in area were not plotted except in cases where associated features, such as tramways, finger dumps or

buildings were visible. Large quarries were plotted regardless of whether or not there were associated features. This was in line with then current NMP guidelines.

In 1999 a proposal was made for an audit of Cornish quarries at a conference entitled *The conservation value of abandoned pits and quarries in Cornwall* organised by the Derelict Land Advisory Group. Although a project design was not produced until November 2000 the mapping policy on quarries was amended in order to provide data for the proposed audit. From 1999 onwards all quarries were plotted regardless of size or whether they appeared on OS maps.

6.3 Detailed Archaeological scope

Levelled features

All archaeological features levelled by ploughing or some other agency, appearing on photographs as cropmarks, soilmarks, or parchmarks, were mapped and recorded.

Earthwork and stonework features

All upstanding earthwork or stone-built features were mapped and recorded whether or not they had been previously surveyed. Where previous surveys did exist (including OS mapping) these were used as the basis for the NMP plots.

In cases where monuments are visible as earthworks on historic photographs but only as cropmarks on recent photography, these monuments were recorded as earthworks.

Maritime and intertidal features

All features visible in the intertidal zone, such as submerged field boundaries, wrecks, hulks, and oyster beds, were transcribed and recorded.

Field boundaries

Field boundaries already mapped by the OS (the 1880 First Edition map was the earliest source consulted) were not transcribed.

There were occasional exceptions. Formerly extensive field systems which had been subject to wholesale field boundary removal are shown on First Edition OS maps. In some cases additional unmapped boundaries are also visible on aerial photographs. If only these additional boundaries were plotted they would appear on the transcription as a random group of isolated linear features. Therefore some of the previously mapped boundaries were also transcribed in order to clarify that the additional boundaries form part of a coherent field system.

Ridge and furrow

All ridge and furrow was transcribed and recorded. Extant ridge and furrow was differentiated from plough-levelled ridge and furrow by the use of two different drawing conventions (see Appendices 9 and 10). Field divisions, where not shown on OS maps, were also transcribed.

Mining features (including china clay extraction)

The development of a strategy for the recording of mining features is set out in section 6.2.1, and the similar strategy for the recording of disused china clay workings in section 6.2.2 above.

To summarise, all mining and china clay extraction remains were plotted in as much detail as was practical.

Quarries

The development of a strategy for the recording of quarries is set out in section 6.2.3 above.

To summarise, small-scale quarrying was not plotted or recorded prior to 1999. After this date, from Block 6 onwards (Appendix 2), all quarries were recorded regardless of their size or complexity.

Twentieth century military archaeology

In line with other NMP projects, military sites were normally transcribed and recorded. Discrete sites such as pill boxes and searchlight batteries, and small composite sites such as anti-aircraft batteries and coastal batteries, were all mapped in full.

The situation is more complex with buildings forming part of large composite sites such as extensive military camps. In the early part of the project these were usually transcribed by indicating the extent of the site with a dashed line. After the adoption of AutoCAD in 1998 (Appendix 1), all the buildings on these sites were drawn digitally.

Airfields were treated differently because HES hold copies of 1945 RAF airfield plans showing and describing all the buildings and installations contained within the airfield perimeters. For this reason airfields were normally mapped by simply defining their extent with a dashed line. There were two exceptions to this: firstly where the 1945 plans were not available, second where unmapped features were visible on the photographs. One example of this is airfields camouflaged by replica field boundaries. In these cases the bogus field systems were transcribed.

Buildings

Unroofed buildings, buildings reduced to foundations, and buildings visible as cropmarks, soilmarks, or parchmarks were transcribed and recorded. Normally, roofed buildings were not recorded but there were two exceptions to this general rule.

In some complex industrial landscapes roofed buildings were visible on historic photographs but not on any OS maps. These buildings were only in use for a short period during the mid twentieth century; constructed after the Second Edition OS mapping of 1907 but demolished before the six-inch mapping of 1963. These buildings were transcribed and recorded.

The second case involves buildings forming part of twentieth century military sites. The strategy for mapping these buildings is set out above.

Landscape parks and gardens

All park and garden landscape features (including deer parks) visible on aerial photographs but not previously recorded by the OS were plotted. Similarly country houses, completely or partially demolished during the period of photography, were mapped and recorded in detail.

Transport features

Major transport features, such as disused canals and main railways, are included in the OS sphere of interest and appear on OS mapping; these were not plotted and recorded. Smaller features, such as tramways associated with mines or quarries, were mapped and recorded.

Trackways, pathways and roadways interpreted as post medieval or earlier in origin and not already recorded by the OS were mapped and recorded.

Modern features

Twentieth century industrial sites and military sites are dealt with under the appropriate headings above. A number of features other than these were also transcribed and recorded, such as land drains, steam ploughing marks, former orchards and domestic peat cutting and drying.

Natural features

Geological, geomorphological, and other natural features were not mapped except in a few cases when alternative, archaeological interpretations were possible. In these cases the site records were double-indexed in the HER with both interpretations.

7 Sources

7.1 Aerial photographs

More than 50,000 aerial photographs were consulted during NMP mapping of Cornwall and the Isles of Scilly.

A quantification of all aerial photographs for Cornwall and the Isles of Scilly was funded by RCHME and carried out during the autumn of 1993 (Young, 1994). The quantification identified 47,492 photographs available for consultation at that time. Of these 34,195 were vertical prints and 13,297 specialist oblique prints.

Over the course of the project further reconnaissance has been carried out by both HES and the NMR. The holdings of the NMR collection have also been increased considerably by the accessioning of further vertical photographs and the acquisition of oblique military photographs (Helen Winton, pers comm.). Some of this new photography was also consulted, but resources were not available to review new photography of areas for which recording had already been completed.

The photographs are dispersed between four main collections, shown in table 1 below. It should be noted that there is a considerable amount of duplication between the NMR, HES, and CUCAP/ULM collections.

Table 1. *The main aerial photographic collections identified in the quantification assessment*

Name and address of repository	No. of photos held	Type of photography held
NMR collection National Monuments Record Centre English Heritage Kemble Drive Swindon SN2 2GZ	33,025	Vertical & oblique
CCC collection Cornwall County Council Historic Environment Service Kennall Building Station Road Truro TR1 3AY	23,211	Vertical & oblique
CUCAP/ULM collection Air Photo Library Cambridge University Unit for Landscape Modelling Sir William Hardy Building Tennis Court Road Cambridge CB2 1QB	4,354	Vertical & oblique
Imerys collection Imerys Par Moor Road Par St Austell PL 24 2SQ	5,126	Vertical

7.1.1 The NMR collection

The most important collection consulted during the project was that held at the EH National Monuments Record Centre in Swindon. At the time of the quantification assessment this collection consisted of 23,080 black and white vertical prints and 7,716 specialist obliques; these were mostly black and white, but included some colour prints, from a variety of sources. Since then more than 3,000 photographs have been acquisitioned and a total of 33,025 photographs were loaned to the project.

Vertical photography

The vertical photography contained in the NMR collection was taken at various scales for non-archaeological purposes, such as military and cartographic reconnaissance and civil engineering projects. For Cornwall's NMP the principal sources of vertical photography held at the NMR are listed in table 2 below.

Table 2. *The principal sources of vertical photography in the NMR collection*

Source	No. of prints held	Date range of photos
RAF	14,241	1942-1964
Ordnance Survey	3,298	1961-1989
Meridian Airmaps Ltd	2,883	1959-1980
Geonex Ltd	381	1973 and 1987
United States Air Force	193	1943-1944
BKS Air Surveys Ltd	163	1960-1980

All vertical photographs at a scale of 1:20,000 or greater were loaned and consulted. The NMR provided laser copies of photographs for which prints were not available. These comprised RAF and United States Air Force photographs taken during the Second World War.

A full list of NMR verticals consulted during the project is contained in the cover search listings accompanying each loan. These listings are contained in the project archive and are summarised in Appendix 5 of this report.

Oblique photography

The NMR collection contains oblique photography from a range of sources, which are listed in table 3 below.

Table 3. *The sources of oblique photography in the NMR collection*

Source	No. of prints held	Date range of photos
Cornwall HES	5,102	1984-2006
NMR	4,604	1975-2006
CUCAP/ULM	568	1948-1977
Harold Wingham	368	1960s
Devon HES	114	1980s
James Pickering	77	1960s

The main source of oblique photography is Cornwall HES and there is, consequently a high degree of duplication between the NMR and CCC collections. In order to mitigate against gaps in the CCC collection, all available prints held in this collection were

borrowed and consulted during the project. A full list of NMR oblique photography consulted during the project is contained in the cover search listings accompanying each loan. These listings are contained in the project archive and are summarised in Appendix 5 of this report.

7.1.2 The Cornwall County Council collection

The CCC holdings consist of two collections held at separate repositories. The first is at the HES offices; the second at the office of CCC Technical Support Service.

HES photographs

The Cornwall HES collection contains 6,743 specialist oblique photographs and 4,130 vertical prints.

The bulk of the oblique collection results from the HES Aerial Reconnaissance Project, which has been ongoing since 1984. Other oblique prints have been acquired over the years or have been selectively copied from negatives held in the NMR and CUCAP/ULM collections. All these photographs were consulted during the project.

The vertical photographs are from a range of sources and have been acquired as a result of archive deposition. All these photographs were consulted during the project.

There are also 5,711 colour slides in the HES collection taken during the Aerial Reconnaissance Project. Because of the difficulty of using slides with AERIAL 4 transcription techniques (Appendix 1) and the cost of producing print or digital copies of slides, the slide collection was not systematically consulted during the project. This should not be regarded as a major omission because the slide collection duplicates, to a large extent, the black and white print collection. On a few occasions, where additional detail was visible, colour slides were used to enhance transcription.

Technical Support Service photographs

The Technical Support collection contains 12,423 vertical photographs. These consist of partial coverage from the RAF UK survey of 1946-48, two 1:10,000 Census Survey flights from 1988 and 1995/6, and a small number of 1:3000 scale photographs of urban areas taken by Meridian Airmaps Ltd.

All the RAF photography held by CCC is also held in the NMR collection and was loaned to the project by the NMR. Therefore the CCC RAF verticals were not consulted. The 1988 Census photography, in colour print format, was systematically consulted during the project. The 1995/1996 Census photography, also in colour print format, became available in 1997 and was consulted from that date onwards. The Meridian coverage was consulted where appropriate.

For the purpose of this report the two collections are treated as one. The principal sources of photography in the collection are summarised in table 4 below.

***Table 4**. Sources of aerial photography in the CCC collection*

Source	No. of photos	Date range of photos
Oblique photography		
Cornwall HES	5,102	1984-2006
NMR	975	1975-2006
CUCAP/ULM	312	1948-1977
Prof. B Jones	204	1970s
Devon HES	114	1980s
Jim Pickering	150	1960s

Vertical photography		
RAF	6,024	1946-1948
Geonex Ltd	2,912	1988
BKS Survey Ltd	2,919	1995-96
Ordnance Survey	2,057	1966-1973
Meridian Airmaps Ltd	1,304	1963 and 1967
CUCAP/ULM	613	1977
Cartographic Services Ltd	450	1984-1985
Faireys Survey Ltd	213	1973
Photoair	62	1986

There is a considerable overlap between the photos, both oblique and vertical, held at CCC and those held by the NMR. For the sake of simplicity, and to minimise the chance of errors when ordering loans, all available photographs held by the NMR were loaned and consulted by the project team.

All oblique photographs in the HES collection are represented as dot data on the GIS and are recorded in the HER photo database. A full list of vertical prints held by HES is contained in the project Quantification Assessment (Young, 1994) which is deposited in the project archive. All verticals held by Technical Support Services are represented as dot data on the CCC GIS.

7.1.3 The CUCAP/ULM collection

The CUCAP/ULM collection (Cambridge University Committee for Aerial Photography, whose collection is housed at the Unit for Landscape Modelling) contains 2,067 verticals and 2,322 oblique prints, of which 568 are also held in the NMR collection. In the years prior to the NMP project copies of 312 selected oblique prints in the collection had been purchased by Cornwall HES.

During the quantification assessment the collection was assessed on site and it was decided there would be no gain in any further purchases. The vertical collection was assessed at the same time and it was felt that this would be a useful source for the project.

At the outset of the project there was no workable loan arrangement between CUCAP/ULM and external NMP projects so consultation of the collection would have to be carried out at the Cambridge library. Given the long distance involved and travel, accommodation and subsistence expenses that would inevitably be incurred, such a working arrangement was not deemed cost effective.

Consequently the only CUCAP/ULM photography consulted during the project was that held by HES and NMR. Listings of the photographs held by HES are presented in the quantification assessment which is contained in the project archive. Listings of CUCAP/ULM photography loaned from the NMR collection are contained in the cover search listings accompanying each loan. These listings are contained in the project archive and are summarised in Appendix 5 of this report.

7.1.4 The Imerys collection

The china clay industry in Cornwall is now operated by Imerys but, at the beginning of the project was run by English China Clay International (ECCI). ECCI had a policy of commissioning regular aerial surveys of their area of operations. The flights were

carried out roughly every four years between 1948 and 1984 by Huntings Survey Ltd (now part of Aerofilms Ltd).

In total the collection amounts to 5,126 high quality 1:10,000 black and white vertical prints. Although this collection is an important resource it was not possible to loan the photos, so consultation of the collection would mean on-site working at the Imerys offices in St Austell. Given that the NMR collection contains a large number of RAF verticals covering a similar time span (1945-1964) it was not deemed cost effective to consult the entire collection. One of the sorties, however, was carried out in August 1976 during a period of drought and it was anticipated that there may be previously unknown cropmark features visible on those photographs. The intention was to consult this particular set of photographs but, in the event, because of pressure on time and resources this was not possible.

The photographs from the 1976 Huntings Survey flight, currently housed at the Imerys office in Par, St Austell, remain an untapped, potentially valuable source of archaeological information.

7.2 Data sources

7.2.1 Historic Environment Record

Reference to the Cornwall HER and the Isles of Scilly HER was integral to project methodology. The information comprised site location and details contained in the Sites and Monuments Record, the Cornwall and Isles of Scilly Historic Landscape Characterisation (HLC), Scheduled Monument data, and the First and Second Edition OS maps of 1880 and 1907.

This information was accessed through the HER databases and maps. From 1994 to late 1998, the map information could only be accessed through HER map overlays, but from 1998 onwards was available on the HES GIS.

7.2.2 National Monuments Record

Likewise reference to the NMR was integral to project methodology. The information comprised site location and details contained in the AMIE (formerly Monarch) Records Descriptions, the NMR 1:10,000 paper maps, and the AMIE Event Record (formerly the National Excavation Index).

7.2.3 Other data sources

Reference to other sources was made whenever appropriate. These sources comprised data from previous aerial photographic transcriptions (section 4.2), field surveys, geophysical survey, excavations plans, and current OS maps.

Aerial photograph transcriptions from the Bodmin Moor Survey were used as the basis for NMP mapping. Existing field surveys, excavation plans, and geophysical surveys were used in the same way wherever practical. In cases where previous aerial survey existed in the form of sketch plots, these were used as interpretative guides only. Current (and earlier) OS maps were used to form the basis for NMP plotting of earthwork features (such as hillforts) already mapped by the OS.

8 Methodology

Given the longevity of the project it is inevitable that methodology evolved over time because of technological developments. The original methodology is summarised in the project design of 1995 (Young 1995A).

Initial procedures involved manual transcription techniques. From late 1998 onwards, mapping was carried out in a digital format using AutoCAD software: the change to working practices resulting from this development are set out in the revised project design (Young, 1999).

From early 2000, the specialist software used for photo rectification was upgraded and this significantly altered the techniques used for producing the finished maps. These techniques are set out in the fourth revised project design (Young, 2003). Since then further minor refinements to project methodology have taken place.

The developments in methodology are summarised in tables 5 and 6 below. A full description of project methodology is set out in Appendix 1.

Table 5. *Summary of developments in transcription methodology, 1994-2006 (see also Figure 7)*

Date	Method
January 1994 – October 1998	Aerial 4.2 rectification. Manual plotting. Pencil and ink overlays
October 1998 – February 2000	Aerial 4.2 rectification. AutoCAD drawing. Ink overlays. GIS
February 2000 – June 2000	Aerial 5 rectification. AutoCAD drawing. Ink overlays. GIS
June 2000 – August 2003	Aerial 5 rectification. AutoCAD drawing. Ink overlays. GIS with data attached
August 2003 – May 2006	Aerial 5 rectification. AutoCAD drawing. GIS with data attached

Table 6. *Summary of developments in data recording methodology, 1994 – 2006*

Date	Method
January 1994 – April 1996	Site Record Form. Morph 2. Partial HER input
July 1996 – October 1998	Site Record Form. Morph 2.
October 1998 – January 2006	AutoCAD annotation. Morph 2. HER input
January 2006 – September 2006	AutoCAD annotation. Morph 2. HER input. HER backlog

Regardless of the techniques used, there were six elements to project methodology.

8.1 Preparation

Prior to mapping preparation comprised identifying and obtaining all relevant aerial photographs, organising the photographs by kilometre square and collating all HER and NMR record data, First and Second Edition OS maps, and other data for each OS quarter map sheet.

8.2 Transcription

Transcription techniques evolved significantly over the lifetime of the project and technological developments led to two major revisions of transcription methodology.

During the first four years of the project, project output consisted of line drawings on 1:10,000 translucent map overlays, using standardised conventions and line widths (these are set out in Appendix 9). The drawings were produced using a combination of manual plotting and manual transcription of computer-generated rectified plots. Rectification of photographs was carried out using AERIAL 4.2 software.

In line with NMP projects, AutoCAD was introduced to project methodology in late 1998 and from this date onwards all drawings were produced in digital format.

An upgrade of AERIAL software to version 5 in 1999 had significant implications for project methodology. The principal difference between AERIAL 5 and previous versions is that the output is a rectified photo image rather than a plot or file of a rectified image digitised from a photograph.

Maps drawn using AutoCAD were exported as shapefiles to form a Vector layer on GIS. Until June 2000 project staff were unable to attach data (site ID numbers) to the shapefiles. In June 2000 the technique for achieving this was acquired and all features mapped since then have data attached.

Maps drawn as ink overlays before AutoCAD was introduced as part of project methodology were scanned by EH and are available as a Raster layer on GIS. The NMP Raster layer was automatically vectorised to an acceptable standard in September 2006, although obviously this layer has no data attached.

8.3 Data Processing

Details of sites plotted during the project were recorded in a number of ways. Initial interpretative notes were made - at first on paper forms but, after the introduction of AutoCAD, in electronic data tables attached to each AutoCAD drawing.

All individual sites and archaeological features plotted during the project were recorded in the project Morph2 database. Morph was originally created as a means of recording cropmark features on aerial photographs in an objective way (Edis et al, 1989), but for the purposes of NMP was adapted as a means of recording all mapped sites regardless of whether they survive as cropmarks or upstanding features.

In addition to recording each site in Morph, data resulting from the project was input to Cornwall's HER. If an HER record already existed for a site plotted as part of the project then that record was updated with text added to the site description, with the Morph ID number for the site, and with the serial numbers of the photographs on which the site is visible.

New HER records were created for previously unrecorded sites. The HER input form was simplified to reduce the time taken for record input, given the large amounts of data being incorporated as a result of the project (Appendix 8).

All the ink overlays were inscribed with each site's HER number. From October 1998 onwards, HER numbers were attached to individual sites in the AutoCAD drawings, using standardise tables (Appendix 11). After June 2000, this data was also exported in the Arcview shapefiles into the GIS. This means that by clicking on any given feature in the GIS layer, its HER number and summary record can be viewed on screen.

8.4 Post recording

As each block of maps was completed, the original ink overlays were deposited at the NMRC in Swindon and copies retained at HES.

As each map sheet was completed two customised copies of the AutoCAD plot were made. One copy to be deposited at NMRC (formatted by removing the OS map background), and one copy to be exported to the CCC GIS with map background, Morph layer and grid removed.

A copy of the Morph2 database was deposited at NMRC.

Copies of all new and updated HER records resulting from the project were deposited at NMRC in order that this information be incorporated into the NMR.

8.5 Miscellaneous

Under this broad heading there are a number of important elements.

8.5.1 Progress meetings

Monitoring meetings between project staff and EH project officers were held on a regular basis. Their purpose was to monitor the ongoing progress of the work, exchange information and discuss issues affecting the project.

Annual progress meetings were held in conjunction with other NMP projects. The purpose of these was to report not only overall progress but also finds of particular archaeological interest, and to keep abreast of latest thinking and technological developments within the NMP nationally. Annual progress meetings were often attended by EH senior managers and offered an opportunity to raise the profile of the project.

8.5.2 Progress Reports

From 1999 onwards Annual progress reports were produced. These summarised progress and highlighted important aspects of the archaeology being recorded.

Throughout the entire project Quarterly reports were produced. These followed a set format and served as a monitoring tool, setting targets for the next quarter and recording whether targets had been achieved for the current quarter.

8.5.3 Training

Project staff received basic training at the National Monument Record Centre in aerial photo interpretation and the use of Aerial and Morph.

Project staff received basic and advanced AutoCAD training from consultant Simon Oliver of Northampton. Simon also provided training for the various AutoCAD upgrades.

Further training not specifically for the project was provided by CCC. This covered Windows XP, Microsoft Outlook, Microsoft Power Point, and Health and Safety.

Some of the annual meetings contained a training element in topics such as twentieth century military archaeology.

8.6 Dissemination

The main dissemination of project results will form the publication phase of the project. This is currently nearing completion.

During the lifetime of the project interim project results have been disseminated in a variety of ways. These are outlined in Appendix 1.

9 Strategy and programming

9.1 Map sheets including part of Devon

Sixteen map sheets straddle the county border with Devon. The parts of Devon included on these map sheets were transcribed as part of the project area but were recorded in a separate Morph2 database.

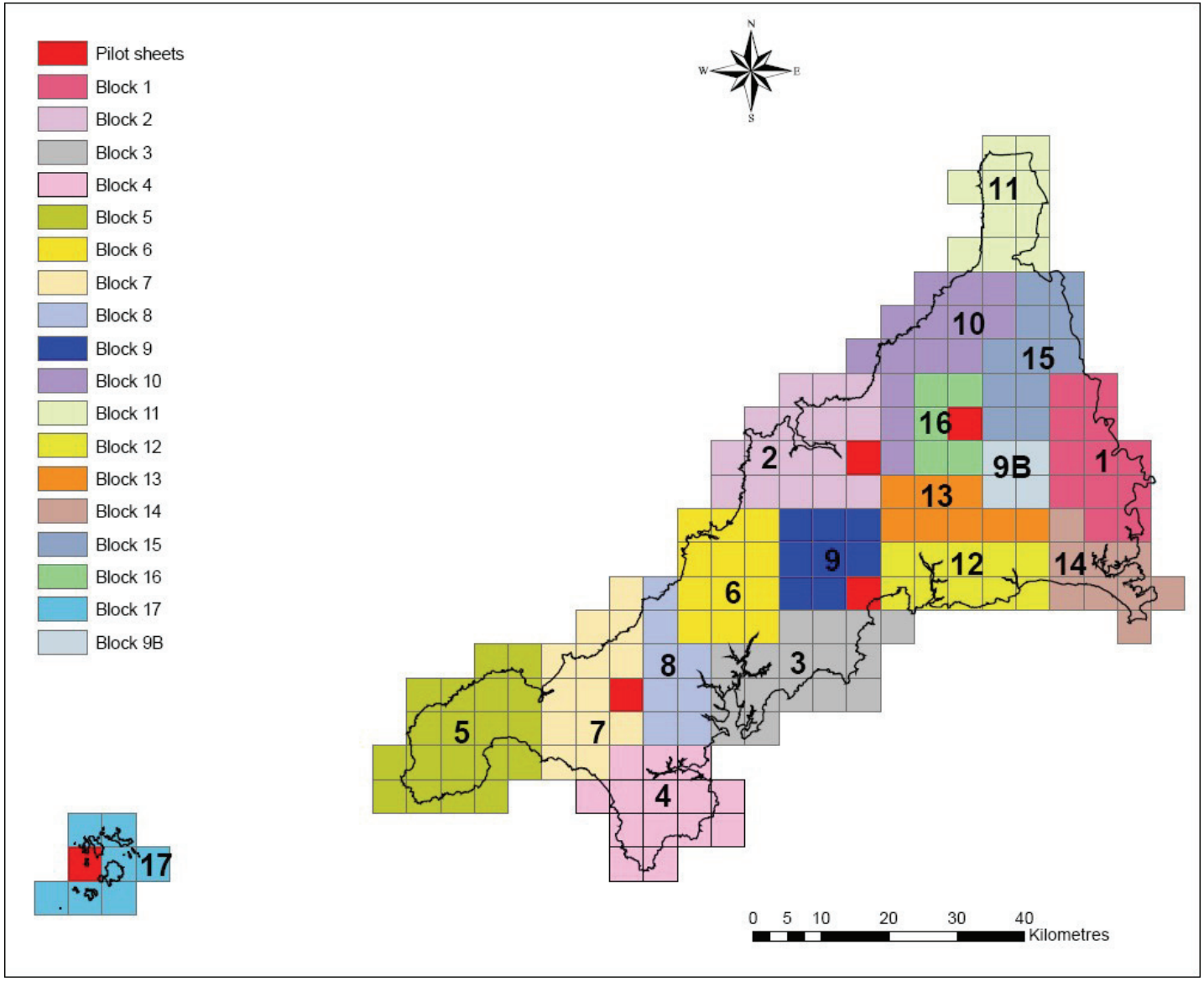
A seventeenth map sheet, SX 38 NE, also straddles the county border. The part of Cornwall covered by this map sheet, however, amounts to less than 5% of map sheet's total area. Therefore this sheet was not mapped, but archaeological features within the Cornish portion of the map were included in plots of neighbouring map sheets.

9.2 Division of the project area in to working Blocks

In line with NMP guidelines the project area was divided into manageable working Blocks (Figure 6). In the original project design, there were 15 Blocks, with an average of 13 1:10,000 OS quarter map sheets per Block. There were also five pilot sheets designed to test timescale estimates over a range of geological and land use scenarios, and over a range of air photo and HER site density levels.

The original organisation of Blocks and their numerical sequence was established to reflect the mapping priorities at that time. During the course of the project these priorities changed and significant alterations were made both to the composition of the Blocks and to the order in which they were mapped. The revised programme is shown in Figure 6 and described in Appendix 2.

Figure 6. *Sequence of working Blocks*



10 Resources and programming

10.1 Project structure and personnel

The project was under the overall control of the head of Aerial Survey (EH) and throughout its lifetime was supervised and monitored by a Project Officer from EH (and formerly a Project Co-ordinator from RCHME). Mapping began in January 1994 and was carried out in the Truro offices of Cornwall County Council HES for the duration of the project.

Over the 12 years during which the project ran, there was a remarkable continuity of personnel with very little staff turnover. All personnel involved in the project are listed in table 7 below. Full details are set out in Appendix 3.

Table 7. *Project personnel 1994 – 2006*

Head of Aerial Survey (RCHME and EH)	Bob Bewley	1994 - 2004
	Pete Horne	2004 - 2006
Project co-ordinator (RCHME)	Carolyn Dyer	1994 - 1998
Project Officer (EH)	Bob Bewley	1998 - 2004
	Helen Winton	2004 - 2006
Project Manager (CCC)	Steve Hartgroves	1994 - 2003
	Andrew Young	2003 - 2006
Project team 1994 - 1998		
Archaeologist (CCC)	Andrew Young	1994 - 1998
Project team 1998 – 2001		
Archaeological Investigator (EH)	Carolyn Dyer	1998 - 2001
Archaeologist (CCC)	Andrew Young	1998 - 2001
Project team 2001 – 2005		
Archaeological Investigator (EH)	Carolyn Dyer	2001-2005
Senior Archaeologist (CCC)	Andrew Young	2001-2005
Archaeologist (CCC)	Emma Trevarthen	2001-2005
Project team 2005 – 2006		
Senior Archaeologist (CCC)	Andrew Young	2005 - 2006
Archaeologist (CCC)	Carolyn Dyer	2005 - 2006
Archaeologist (CCC)	Emma Trevarthen	2005 - 2006
Archaeologist (CCC)	Neil Craze	2006
Archaeologist (CCC)	Emma Ruddle	2006

11 Project management

11.1 Project funding

Funding for the project was initially provided by RCHME in the form of a series of grant payments. Following the merger with EH in 1999, a revised project design was produced and a contract between CCC and EH drawn up. The contract included estimated total costs for completion of the project. These costs were met by a series of stage payments dependant on the achievement of agreed performance indicators.

Three further revised project designs have been produced over the course of the project reflecting changing circumstances and the development of working practices. In order to meet these changes and developments, additional funding was sought through three variations to the project.

The timing and circumstances of these revisions to the project design and variations are outlined in Appendix 4.

11.2 Interruptions to the programme

Work on the project was suspended on three separate occasions.

The first of these was the three month period between April and July 1996 when no funding was available from RCHME. The second was between June 2001 and January 2002, when the project team was commissioned to carry out NMP mapping of an area comprising seven map sheets in west Devon (Taylor, 2002). The third occasion was the 10 month period between January and November 2005, when the project team was commissioned by EH to carry out another NMP project in Devon (Young, 2007). This project was seen as a priority because of increasing pressure for land use change in parts of central and west Devon.

11.3 Changing staff circumstances

Over the course of the project there were four periods of staff absence due to sickness or maternity leave.

Given that the project spanned 12 years, these events are not out of the ordinary, but could not reasonably be foreseen in the various project design stages.

11.4 Project timetable

In the original project design (Young, 1995A) it was estimated that the mapping and database recording would be completed by January 2001. In the event the mapping phase was completed in May 2006, and database recording in September 2006.

Apart from periods of staff absence there are three main causes of discrepancies between the anticipated and actual timetables.

1. Inaccuracy of original timetable estimates
2. Alterations to the methodology for mapping complex industrial landscapes
3. Effects of technological developments and alterations to working practices

The ways in which these factors affected the project timetable are fully described in Appendix 4.

12 Results

Over the course of its 12 year lifetime the project has produced a huge amount of data. This, in tandem with technological developments during this time, has completely transformed not only the amount of available information about Cornwall's archaeology visible on aerial photographs, but also the way in which it can be accessed.

As a result of the project, coupled with the use of GIS, whole historic and prehistoric landscapes have been mapped and can be viewed in their entirety.

A brief summary of the outcome of the project is outlined below. A more exhaustive presentation of the project results, including on line access to the digital mapping is available on the project website (flyingpast.org), and an analysis of selected results and a discussion of their research potential will be contained in the *Cornish Archaeology* articles (section 5).

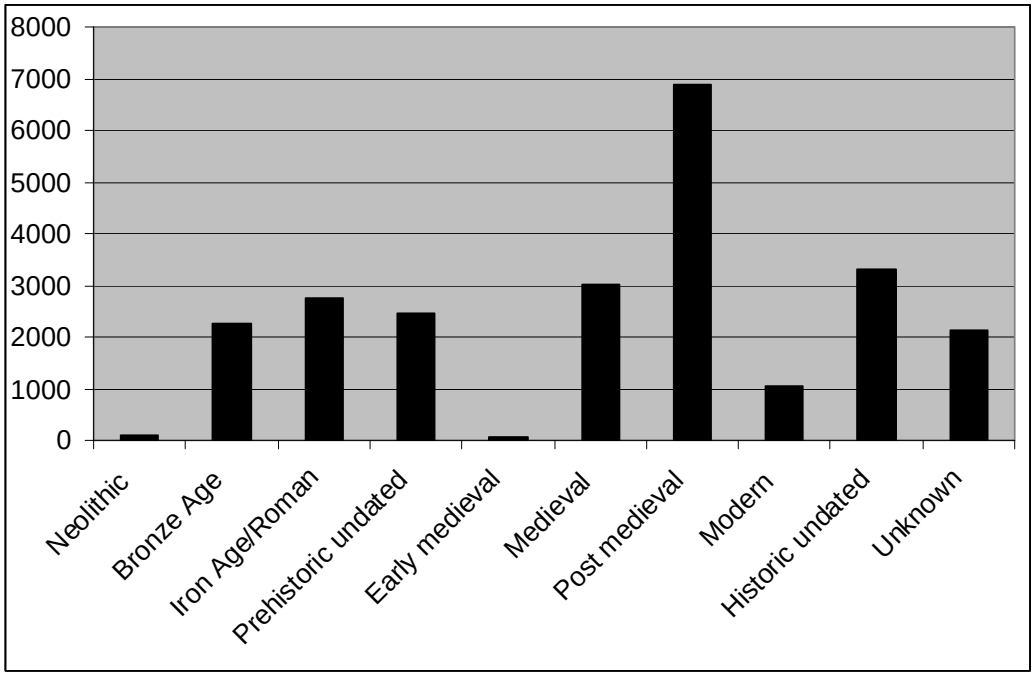
12.1 HER site records

During the project 29,804 archaeological features were transcribed and input to the project Morph2 database. In addition a further 2,204 features located over the Devon side of the county boundary were mapped and recorded in the Morph2 database for Devon.

As a result of the project, 24,045 site records in the Cornwall and Isles of Scilly HER were either created or updated.

Analysis of these site records on a period by period basis is shown in chart 1 below. It should be pointed out that these figures represent numbers of records. In an unquantified number of instances a particular site might have been interpreted as dating from more than one period and this site will appear as two records. Sites which may be Iron Age or Roman, and sites which may be medieval or post medieval are the most frequent instances in which this type of double indexing occurs.

Chart 1. *Total number of HER site records by period*



The majority (59%), of the sites are medieval or later in date, 32% are prehistoric and 9% are of unknown date.

Almost a third of all the records are for post medieval sites. The majority of these are for features associated with tin and copper mining. There are also nearly 2,000 quarries and a similar number of post medieval agricultural features such as field boundaries, field systems, domestic peat cutting, and ridge and furrow.

Sites interpreted as *Historic undated* are those whose date can only be assigned with any confidence as medieval or later. More than half of these are field boundaries, field systems or other agricultural features.

The modern period comprises twentieth century sites: these are characterised mainly by defensive and military features from the Second World War and by sites relating to the china clay industry.

Medieval records are dominated by features reflecting the farming landscape, such as field systems, strip fields, ridge and furrow and holloways.

Records for prehistoric sites are predominantly for features interpreted as Bronze Age or later. The vast majority of Bronze Age records are for barrows and cairns, with settlements and associated field systems making up only 10% of the total. It is difficult to differentiate Iron Age sites from Roman (other than sites such as hillforts) and in the project database there is a considerable degree of double indexing between the two periods. In summarising site records it is convenient to consider the Iron Age and Roman as one period (c800 BC – AD 410). The predominant features are enclosures and enclosed settlements (Cornish rounds), of which roughly 2,000 were recorded.

A further 700 enclosures were interpreted as prehistoric of uncertain date (referred to in chart 1 as *prehistoric undated*). Almost one thousand round houses or unenclosed round house settlements are interpreted as prehistoric undated (generally these are considered to be Bronze Age or Iron Age) as well as nearly 1,300 field boundaries and field systems.

Site records for the Neolithic period are represented mainly by chambered tombs, entrance graves, stone circles and standing stones.

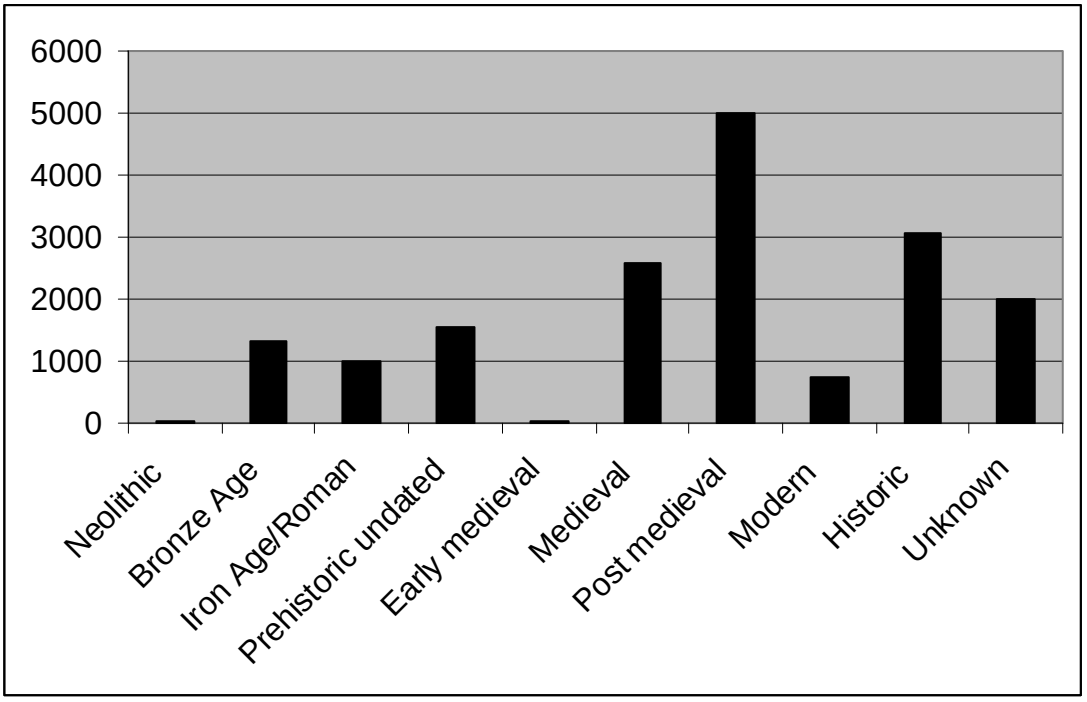
The majority of the sites recorded (62%) have extant earthwork or stone remains whereas only 31% were recorded as cropmarks (the remaining 7% of the sites have since been destroyed and were recorded as ‘site of’). The high proportion of extant sites reflects the large number of features associated with tin and copper mining, the good survival of monuments in the upland areas of Cornwall, and the large number of sites transcribed from 1940s and 1950s RAF vertical photography which survived as earthworks at that time but which may have been plough-levelled in recent decades.

12.2 New site records

Of the 24,045 sites recorded in the HER, 18,215 (75%) were previously unrecorded and are new discoveries resulting from the project. Only 3,424 of the recorded sites were included in the NMR, so 85% of the sites identified during the project are new to the national record

Analysis of the new sites on a period by period basis is shown in chart 2 below.

Chart 2. *Total number of new HER site records by period*



The period by period profile of the new sites is almost identical to that of the recorded sites generally. The main difference is that sites of uncertain or unknown date form a higher proportion of the new sites.

Records for post medieval sites are again the most numerous (4,795 in total) and are almost all either mining features, agricultural features or quarries.

Records of *Historic* date are predominantly agricultural in character, as are those interpreted as medieval.

Two thirds of the Iron Age and Roman new site records are for enclosures or enclosed settlements. More than 600 enclosures are interpreted as prehistoric (undated) as well as large numbers of field boundaries, field systems and round houses.

The sites of uncertain date include a variety of site types, but more than a third are enclosures.

12.3 Significant project outcomes

Various aspects of the project results are of particular significance. These can be considered under two broad categories.

12.3.1 Archaeological themes

There are four areas where NMP has added significantly to our knowledge of Cornish archaeology or has broken new ground.

The first is the nature and extent of settlement in the late prehistoric and Romano-British period. More than 2,000 new enclosures interpreted as dating from this period

were recorded during the project. A high proportion of these sites are likely to be enclosed settlements, and the numbers of enclosures recorded indicate that a reappraisal of the settlement pattern in Iron Age and Roman Cornwall, based on NMP data, would be a fruitful topic for future research.

The second is the identification and accurate mapping of early mineral extraction features. In particular almost 300 new tin streamworks were mapped; some are likely to have their origins in the medieval period and represent the earliest recorded tin workings in the county.

The third is the systematic recording of defensive and military features dating from the Second World War. At the outset very few features of this type were included in the HER; the project has recorded more than 500. Of particular importance are a number of temporary installations, of which the best example is the series of tented camps housing troops in the build-up to the D Day invasions of 1944, which were photographed by the United States Air Force in the area to the north of Falmouth. Wartime aerial photographs are the only effective source for the location of ephemeral features such as these.

The fourth is the recording of new examples of prehistoric sites which are rare in Cornwall or which were absent from the county record prior to the project. A number of prehistoric unenclosed round house settlements have been recorded in lowland Cornwall, for instance. The best example is that at Lellizzick, near Padstow, which was verified by follow up geophysical survey. More unusual sites recorded during the project include several possible henges, a possible mortuary enclosure, and a possible cursus monument. Detailed comparative analysis of the enclosure dataset is likely to suggest more examples of rare types of site and this would be a useful topic for further research.

12.3.2 The use of NMP data

Data resulting from the project represents a major enhancement to the HER. As such it is consulted on a daily basis by a range of end users, including members of the public.

NMP data informs strategic and individual planning decisions in Cornwall and the Isles of Scilly. As an integral part of the HER, the data is regularly and routinely consulted during archaeological assessments and evaluations carried out by both HES and other archaeological organisations. It is also used by Cornwall's Historic Environment Advice team to inform the management of agri-environment schemes, such as Higher Level Stewardship Schemes.

On a wider level, the dataset facilitates decisions regarding the management, preservation and research of archaeological sites and historic landscapes within Cornwall and the Isles of Scilly. An example of this is information provided by the data to the EH Monuments Protection Programme.

One of the chief ways the data is used to this end is as a contributory source in the development and delivery of large scale management projects across the county. An ongoing example is Cornwall's HEATH project, which is part of Tomorrow's Heathland Heritage Programme project. NMP mapping provides a key dataset in the process of identifying and mapping all archaeological sites in Cornwall's heathlands, essential in achieving the HEATH project's aim of 'achieving greater understanding of the relationships between the natural, historic, and cultural aspects of west Cornwall's heathland and promoting their mutual conservation through integrated, informed, and beneficial management policies' (Herring, 2005).

The most significant contribution so far provided by NMP data was to the Cornwall and west Devon Mining Landscape World Heritage Site project. The designation of World Heritage Site was awarded to Cornwall's mining landscape in July 2006. As part of the project that put together the WHS bid, the nature and extent of the archaeological

remains of the mining industry needed to be defined. NMP provided 40% of the data collated by the WHS team during that phase of the bid project (CCC, 2004).

In addition to the WHS project, NMP data has been integrated into a range of other large scale projects.

Isles of Scilly Rapid Coastal Zone Assessment

Fal Estuary Audit

Fowey Estuary Audit

Hayle Estuary Audit

Camel Estuary Audit

Stratton Hundred Rapid Identification Survey

Tamar Valley Market Garden Project

Defence of Britain Project

13 Project Archives

13.1 Summary of the project Archive

Items relating to the project are deposited in the archive at the National Monuments Record Centre (NMRC), Kemble Drive, Swindon SN2 2GZ and at the office of the Historic Environment Service, Cornwall County Council (CCC), Kennall building, Old County Hall, Station Road, Truro TR1 3AY.

The various items making up the project Archive are summarised in table 8 below

Table 8. *Summary of the project archive*

Archive	Swindon	Truro
Original ink overlays	171 maps	N/A
Copies of ink overlays	N/A	171 maps
AutoCAD plots	133 maps	133 maps
Arcview shapefiles	133 maps	133 maps
Cornwall Morph 2 database	29,804 records	29,804 records
Devon Morph2 database	2,204 records	2,204 records
Map Note Sheets	202 maps	202 maps
Site Record Forms	N/A	Record forms for 80 maps
Project design	Hard copy	Hard copy
Revised project designs*	Digital versions	Digital versions
Quantification Assessment	Hard copy	Hard copy
Management Report	Digital version	Digital version
Annual Reports	7 reports	7 reports
NMR Photograph loan lists	17 lists	17 lists
CAU Photo database	N/A	Database
CCC Photograph database	N/A	Database

* Four revised project designs and two variation requests.

13.2 Format of the Archive

Project methodology evolved as a result of technological developments (described fully in Appendix 1). As a result of these developments the nature of the Archive material is not uniform. The key inconsistencies in the project archive are summarised below.

13.2.1 AutoCAD plots

AutoCAD was not used until late 1998 so no AutoCAD plots were made before that date. At a later date the 12 map sheets making up Block 1 (Tamar Valley) were updated in AutoCAD as part of the west Devon NMP project (section 11.2) and one of the pilot sheets (SV 81 SE in the Isles of Scilly) was also updated. The archive includes AutoCAD drawings for 135 map sheets.

13.2.2 Ink overlays

As a time-saving measure, the production of ink overlays was abandoned in August 2003. The archive includes ink overlay drawings for 171 map sheets.

13.2.3 Site Record Forms

These forms were used early in the project to record details of sites plotted (Appendix 1). With the introduction of AutoCAD in 1998, this practice was abandoned and instead the information was attached directly to individual features in the AutoCAD drawings. The archive includes Site Record Forms for 80 map sheets.

13.3 Data in the GIS

Cornwall County Council's Geographical Information System (GIS) was brought online in 1997. All mapping produced during the project is incorporated into the GIS, but at three different levels.

13.3.1 Map sheets drawn only as ink overlays

The 67 map sheets for which only manual transcriptions exist were scanned and appear in the GIS as a Raster layer. No HER data is attached to this layer with the exception of mining features (this was done separately as part of the WHS project). The 67 map sheets forming the Raster layer in the GIS were vectorised in September 2006.

13.3.2 Map sheets drawn in AutoCAD with no HER data attached

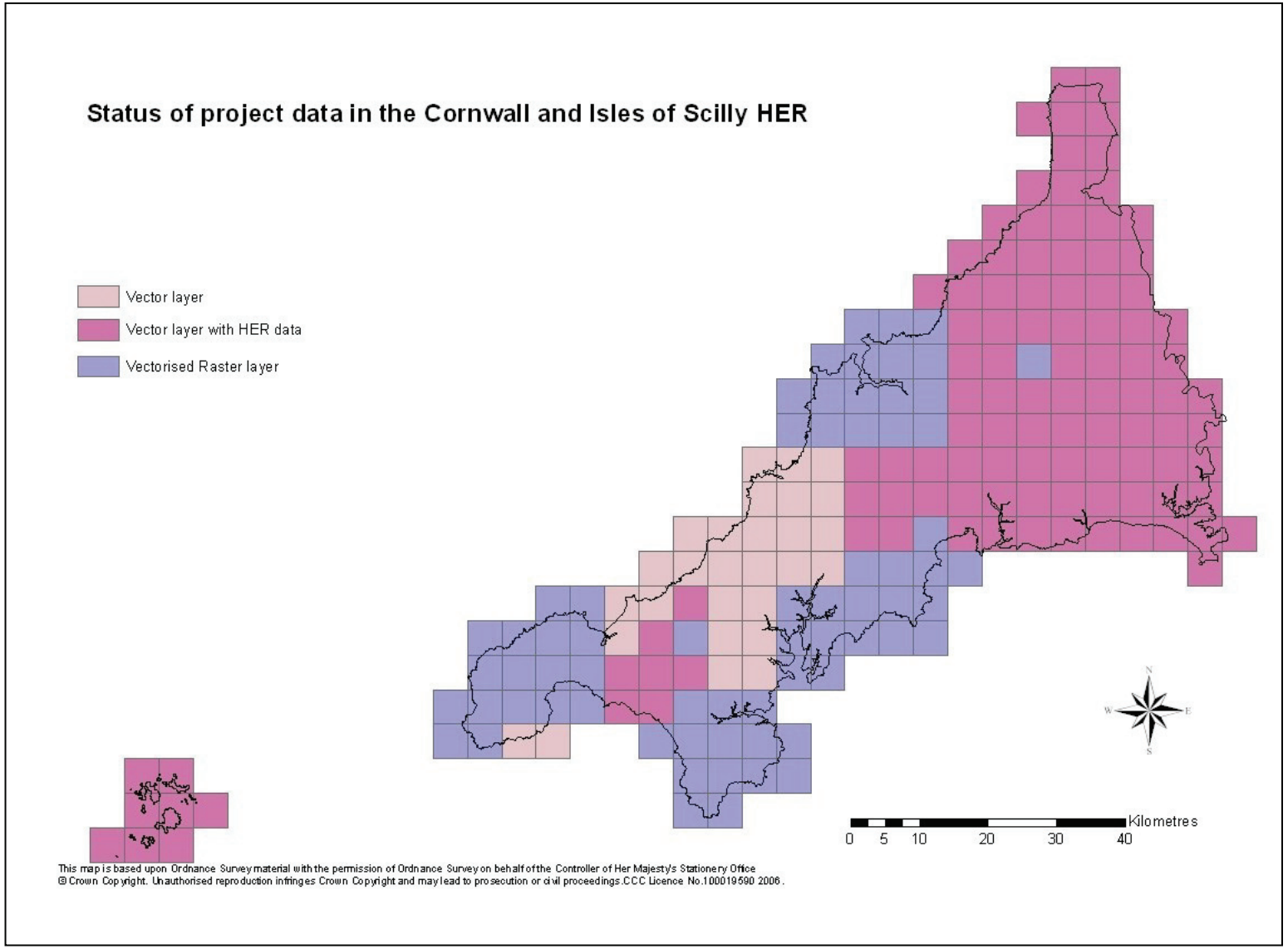
All maps which were digitally transcribed in AutoCAD were exported as Arcview shapefiles and form a vector layer in the GIS. When AutoCAD was first introduced as part of project methodology, project staff did not have the expertise to attach HER data to the objects contained in the drawings. Shapefiles for 28 map sheets without attached data are contained in the GIS.

13.3.3 Map sheets drawn in AutoCAD and with HER data attached

From June 2000 onwards the expertise to attach HER data to AutoCAD drawings had been developed and all maps completed after this date were incorporated into the GIS with HER data attached. This amounts to 107 map sheets.

The three different levels of data incorporated into the GIS are summarised in Figure 7.

Figure 7. *Levels of project data in the Cornwall and Isles of Scilly GIS*



14 Conclusions and recommendations

14.1 Conclusions

Conclusions can be drawn from the project at three different levels

14.1.1 Project results

1. The project aims and objectives were achieved. The large amount of baseline data generated represents a major enhancement of the Cornwall and Isles of Scilly HER. A large number of HER records were updated and an even larger number of new records created. The project has added to our knowledge of the nature and extent of the archaeological resource of lowland Cornwall, and has provided an initial survey of several monument-rich upland landscapes.

2. Initial analysis of the project data has identified two potential directions for future research; the late Iron Age and Romano-British settlement pattern in lowland Cornwall, and a programme of further analysis to identify unusual site types.

3. Project data has been of significant value to other large scale resource and management projects and to other landscape surveys in Cornwall.

4. Developments in project methodology resulted in uneven data quality standards for items in the project archive. In particular mapping of features from 95 map sheets in the GIS does not include HER data attachment.

14.1.2 Project management

5. The quantification assessment was not accurate as a basis for the timetable calculations. Complexity of the archaeological landscape within the project area (based on numbers of HER records) was a more reliable indicator of the likely time needed for mapping.

6. The mapping of pilot sheets at the beginning of the project failed to highlight problems with the proposed timetable and served no obvious useful purpose. Most likely this was due to the methodological developments during the lifetime of the project (Appendix 1).

7. Initial timetable estimates did not include time for essential non-mapping tasks. Nor was time allocated for project management duties including the preparation of revised project designs and project variations. As far as it is possible to quantify, analysis of documentation indicates that 20% of project time was spent on these various tasks.

8. Quarterly reports, whilst providing a broad guide to overall progress and serving a useful function in setting targets, were inadequate as the sole means of documenting progress. The report format did not include any itemisation of non-mapping tasks referred to in the previous point.

9. The mechanism for loaning photographs from the NMRC worked well and there were no problems with NMR photo loans at any time during the 12 year life of the project.

10. There were difficulties with photographic loans from CUCAP/ULM. As a result only those CUCAP/ULM photographs held at CCC and NMRC were consulted.

14.1.3 Wider NMP strategy

11. The NMP mapping of the whole of Cornwall and the Isles of Scilly should be regarded as an outstanding achievement. However, the size of the project and length of time taken for completion made effective management problematic and resulted in inherent inconsistencies within the project outcome.

12. Cornwall and the Isles of Scilly was an external NMP project. This had two advantages over internal EH projects.

- CCC staff with specialist local knowledge and expertise were available for consultation and advice.
- End users (other than the NMR) were easily identifiable and their needs (confirmed through liaison and discussion) contributed towards the development of mapping strategy.

13. The principal disadvantage of an external project was a feeling, at times, of remoteness. In particular there was a lack of awareness of wider NMP strategy.

14. The changes in mapping policy for industrial remains were an important development. These changes were influenced to some extent by the needs of end users. The detailed mapping of industrial remains added to the overall timescale of the project but significantly improved the quality of the end product. The mapping of industrial archaeology in this project raises three issues relating to wider NMP strategy.

- Defining the acceptable balance between quality of output and project timescale
- The issue of whether there is a hierarchy of archaeological value, in which it is necessary to record some site types in detail but not others.
- The question of what is the purpose of the mapping. Defining the correct balance between achieving consistency nationally and tailoring projects to the needs of end users locally.

14.2 Recommendations

On the basis of these conclusions, and from the wider experience of the Cornwall project, the following recommendations are made with the intention of informing future NMP projects.

Some of the conclusions replicate those made from other NMP projects and as a result a number of the following recommendations are already in place in current NMP guidelines (EH forthcoming).

1. The ideal length for a project would be no more than two years. Longer projects are more likely to lead to difficulties in project management and in the practicality of data retrieval and analysis.

2. External project teams should consist of at least two interpreters.

3. Communication between external project teams and EH Aerial Survey could be improved. The annual NMP meeting, for example, could include a session devoted to wider NMP issues rather than concentrating on selected project highlights.

4. At the project design stage, likely end users should be identified and, if appropriate, their requirements incorporated into the project scope.

5. Data exchange agreements should be reached at the project design stage.

6. In estimating transcription and recording timetables most attention should be paid to the likely complexity of the archaeological remains. Extra time should be included if photo cover searches indicate that there is a large amount of photography.

7. Project timetabling must include all non-mapping tasks.

8. Progress recording systems should include a breakdown of all project-related tasks, and should be on at least a monthly basis (preferably weekly).

9. Field trips should be built into project timetables, either as follow-up visits or as exercises in landscape familiarisation.

10. The Morph fields *validity* and *source* are useful to end users. In future projects which do not use MORPH, fields equivalent to these values should be included in the AutoCAD attached data tables.

There are four recommendations for further work.

11. There should be a data enhancement project to attach HER data to the mapped features in the GIS which currently have no data attached.

12. The Huntings Survey flight of August 1976, which is housed at Imerys headquarters in Par, is a potentially valuable photograph collection and an opportunity should be sought to consult it.

13. The numbers of new enclosures thought to be prehistoric which have been recorded indicate that a reappraisal of the settlement pattern in Iron Age and Roman Cornwall, based on NMP data, would be a fruitful topic for future research.

14. Detailed comparative analysis of the enclosure dataset is likely to suggest more examples of rare types of prehistoric site, such as henges, and this would be an important direction for further research.

15 References

Agricultural Land Classification of England and Wales, 1972

Benson, D and Miles, D, 1974. *The Upper Thames Valley: an archaeological survey of the river gravels.* Oxford

Bewley, R, 2001. Understanding England's Historic Landscapes: An Aerial Perspective. *Landscapes* **2** 74 – 84

Clark, J, Darlington, J, and Fairclough, G, 2004. *Using Historic Landscape Characterisation*. English Heritage and Lancashire County Council

Cornwall County Council World Heritage Site bid team, 2004. *Nomination of the Cornwall and West Devon Mining Landscape for inclusion on the World Heritage List*, Cornwall County Council

Deegan, A, *Northamptonshire NMP Project Management Report*, Northamptonshire County Council and English Heritage

Edis, J, MacLeod, D, and Bewley, R, 1989. An archaeologist's guide to the classification of cropmarks and soil marks, *Antiquity,* **63**, 112 - 127

EH, forthcoming. NMP Manual, Appendices 6-8, English Heritage internal document

Herring, P, 1998. *Cornwall's Historic Landscape Presenting a method of historic landscape character assessment*, Cornwall Archaeological Unit

Herring, P, 2005 *Historic environment involvement in the HEATH project* Historic Environment Service project outline for English Heritage

Herring, P, Sharp, A, and Smith, J, forthcoming. *Bodmin Moor An archaeological survey Volume 2*

Herring, P, and Thomas, N, 1993. *Stratton Rapid Identification Survey* Cornwall Archaeological Unit report for RCHME

Horne, PD, and MacLeod, D, 1995. *The Yorkshire Dales Mapping Project: a report for the National Mapping Programme (2 volumes)* Swindon: Royal Commission on the Historical Monuments of England

Johnson, N, and Rose, P, 1982. Defended settlements in Cornwall – an illustrated discussion, in *The Romano-British Countryside* (ed D Miles), BAR Brit Ser 103, 151-208, Oxford

Johnson, N, and Rose, P, 1994. *Bodmin Moor An archaeological survey Volume1: The human landscape to c1800,* English Heritage Archaeological Report no **24**

Kershaw, A, 2001. *Vale of York NMP – Project Review* English Heritage internal document

Nowakowski, J, 1991. *Trethellan Farm, Newquay: Excavation of a Lowland Bronze Age Settlement and Iron Age Cemetery*, Cornish Archaeology **30**

Palmer, R, 1984. *Danebury: An aerial photographic interpretation of its environs*. RCHME Supplementary Series: **6**

Quinnell, H, 2004. *Excavations at Trethurgy Round, St Austell: Community and Status in Roman and Post-Roman Cornwall*, Cornwall County Council

Ratcliffe, J 1997. *Fal Estuary Historic Audit* Cornwall Archaeological Unit

RCHME, 1995. *Guidelines for the production of Project Specifications*, Royal Commission on the Historical Monuments of England internal document

Soil Survey of England and Wales, 1974

Stanier, P, 1990. *Cornwall's Geological Heritage,* Twelveheads Press, Truro

Taylor, E, 2002. *Cornish Mining World Heritage Site Bid NMP Mapping in West Devon*, Cornwall Archaeological Unit and English Heritage internal document

Young, AR, 1994. *The National Mapping Programme Quantification Assessment Cornwall and the Isles of Scilly,* Cornwall Archaeological Unit report for RCHME

Young, AR, 1995A. *Cornwall and Isles of Scilly Mapping Project. Project Specification*, Cornwall Archaeological Unit

Young, AR, 1995B. *Cornwall Archaeological Unit Aerial Reconnaissance Programme,* Cornwall Archaeological Unit

Young, AR, 1999. *Cornwall and Isles of Scilly Mapping Project, Revised Project Design*, Cornwall Archaeological Unit and English Heritage internal document

Young, AR, 2003. *Cornwall and Isles of Scilly Mapping Project, Fourth Revised Project Design*, Cornwall County Council and English Heritage internal document

Young, AR, 2007. *North Devon Mapping Project: A Report For The National Mapping Programme.* Cornwall County Council

Appendix 1 Project Methodology

Given the longevity of the project it is inevitable that methodology evolved over time because of technological developments. The original methodology is summarised in the project design of 1995 (Young 1995A).

Initial procedures involved manual transcription techniques. From late 1998 onwards, mapping was carried out in a digital format using AutoCAD software: the change to working practices resulting from this development are set out in the revised project design (Young, 1999).

From early 2000, the specialist software used for photo rectification was upgraded and this significantly altered the techniques used for producing the finished maps. These techniques are set out in the fourth revised project design (Young, 2003). Since then further minor refinements to project methodology have taken place.

The developments in methodology are summarised in the tables below.

Summary of developments in transcription methodology, 1994-2006 (see also Figure 7)

Date	Method
January 1994 – October 1998	Aerial 4.2 rectification. Manual plotting. Pencil and ink overlays
October 1998 – February 2000	Aerial 4.2 rectification. AutoCAD drawing. Ink overlays. GIS
February 2000 – June 2000	Aerial 5 rectification. AutoCAD drawing. Ink overlays. GIS
June 2000 – August 2003	Aerial 5 rectification. AutoCAD drawing. Ink overlays. GIS with data attached
August 2003 – May 2006	Aerial 5 rectification. AutoCAD drawing. GIS with data attached

Summary of developments in data recording methodology, 1994 – 2006

Date	Method
January 1994 – April 1996	Site Record Form. Morph 2. Partial HER input
July 1996 – October 1998	Site Record Form. Morph 2.
October 1998 – January 2006	AutoCAD annotation. Morph 2. HER input
January 2006 – September 2006	AutoCAD annotation. Morph 2. HER input. HER backlog

Regardless of the techniques used, there were six elements to project methodology.

1 Preparation

Throughout the lifetime of the project, preparation prior to the actual mapping comprised four stages.

- Identify and obtain all relevant aerial photographs listed in the Quantification Assessment and the various cover searches made by the Enquiries and Research team at the National Monuments Record Centre (NMRC) at Swindon.
- Organise oblique photography by kilometre square and vertical photographs by OS quarter map sheet.
- Collate HER and NMR records and maps for each OS quarter map sheet.

- Collate First and Second Edition OS maps, the NMR Excavation Index, and HES survey and excavation plans for each OS quarter map sheet.

2 Transcription

Transcription techniques evolved significantly over the lifetime of the project. Technological developments led to two major revisions of transcription methodology.

2.1 Original methodology: January 1994 – October 1998

From the beginning of the project until October 1998, project output consisted of two series of line drawings on 1:10,000 translucent map overlays. These comprised a pencil version and a final ink version, using standardised conventions and line widths (these are set out in Appendix 5). The drawings were produced using a combination of manual plotting and manual transcription of computer-generated rectified plots.

Manual plotting was made directly onto the pencil overlay drawings. Manual plotting was used in three instances; for simple features (such as field boundaries) plotted from vertical photography, for sites visible on oblique photography where there were not sufficient control points to allow computer-rectified plotting, and for the addition of detail visible on vertical photography to computer-rectified plots.

Computer rectification was used for all features visible on oblique photography (except when insufficient control was available) and for complex features visible on vertical photography. Rectification was carried out using AERIAL 4.2 software developed by Bradford University. This required the photograph to be registered on a digitising tablet and the archaeological features to be digitised prior to rectification. Printouts of the rectified plots were then traced over directly onto the final ink drawings.

During this phase of the project, transcription procedures were as follows

- Select those photographs which provide archaeological information
- Identify those photographs which provide sufficient control information for rectification
- If the archaeological information on the photograph is not sufficiently clear to be digitised directly from the photograph, interpret and trace its outline onto an acetate sheet
- Prepare a paper copy of the relevant area of the background map and mark on at least five control points
- Process the image in AERIAL 4.2. Register the paper map and the photo (or acetate sheet tracing) on the digitising tablet.
- Create a Digital Terrain Model (DTM) if necessary by manually inputting selected contour data from the base map
- Digitise the map control points and the corresponding photo control points
- Check the given error readings. If these exceed 3 metres for any one point, carry out the digitisation again using a new set of control points
- When control with acceptable average error is achieved, digitise the archaeological features, save the rectified image to file, and produce a paper printout
- Trace over printout onto the final 1:10,000 ink drawing
- Sketch plot any extra detail interpreted from vertical photography (where appropriate) and trace onto final ink drawing

- Produce pencil sketch plots of features without sufficient control points for rectification, using the mobius network technique
- Produce pencil sketch plots by eye of simple features (such as straight field boundaries)
- Trace pencil drawn features onto final ink drawing

Block 1 (Tamar Valley), the five Pilot map sheets, Block 2 (Camel Estuary), Block 3 (Fal Estuary and Roseland Peninsula), Block 4 (Lizard Peninsula) and 17 map sheets from Block 5 (West Penwith) were all transcribed using this methodology. In total this amounts to 80 map sheets.

2.2 First revised methodology: October 1998 – February 2000

In line with NMP projects, AutoCAD was introduced to project methodology in late 1998 and from this date onwards all drawings were produced in digital format. Initially the Release 3 version of AutoCAD Map was used; this was later upgraded to versions 2000, and version 2002.

At first maps continued to be manually transcribed and the resultant overlays were simply digitised into AutoCAD. However, working practices were refined at an early stage and it should be assumed that from late 1988, all mapping was carried out in AutoCAD using the method outlined below.

The updated methodology had two main advantages over previous mapping techniques

1. The resulting AutoCAD drawings could be exported into GIS (Appendix 1: 2.4)
2. Features which would previously have been sketch plotted could now be drawn to a more reliable degree of accuracy in AutoCAD

One outcome of the new methodology was that pencil versions of final drawings were no longer required.

During this phase of the project, transcription procedures were as follows

- Set up a drawing in AutoCAD with a grid and standardised layers (Appendix 12)
- Using OS digital data, import the relevant 1:10,000 map tiles into the AutoCAD drawing
- Rectify archaeological images from aerial photography in the same way as before (Appendix 1: 2.1)
- Import the rectified AERIAL image into the AutoCAD drawing
- Interpret and trace over the rectified image in AutoCAD
- Scan photographs showing archaeological features which do not need rectification (see Appendix 1: 2.1 for the relevant criteria)
- Import the scanned photographs into AutoCAD
- Rectify the photographic image in AutoCAD using the *Align* command
- Trace over the archaeological features on the rectified photograph in AutoCAD
- Convert the AutoCAD drawing to an Arcview shapefile and export to GIS (see Appendix 1: 2.4)
- Produce printouts of the AutoCAD drawing at 1:10,000 scale

- Trace over the printouts to produce a final ink drawing on a translucent 1:10,000 map overlay

Block 6 (Truro to Newquay landscape), Block 7 (Hayle and Camborne), 2 map sheets from Block 5 (West Penwith) and 3 map sheets from Block 8 (Redruth, St Agnes and Wendron) were transcribed using this methodology. In total this amounts to 30 map sheets.

2.3 Second revised methodology: February 2000 – May 2006

An upgrade of AERIAL software to version 5 in 1999 had significant implications for project methodology. The principal difference between AERIAL 5 and previous versions is that the output is a rectified photo image rather than a plot or file of a rectified image digitised from a photograph.

In AERIAL 5 a photograph (or a relevant area on a photograph) is scanned, and then rectified on screen. The rectified photograph is exported into AutoCAD and the archaeological features on the image traced over in AutoCAD. Aerial 5 was introduced to project methodology in February 2000 and remains the rectification software used by NMP projects.

There are two principal advantages of this version of AERIAL.

1. The transcriber is no longer constrained by the scale of the photograph (as was the case when digitising from the photograph on a digitising tablet). By tracing over the rectified scanned photo in AutoCAD it is possible to zoom in as far as practicable to the image thereby enhancing the level of detail which can be transcribed and improving the overall accuracy.
2. Prior to being traced in AutoCAD the scanned photo image can be enhanced if necessary in programmes such as Corel Photopaint.

One further advantage of the new methodology was that a DTM could be applied to the rectification process directly from OS contour files rather than requiring manual input. This not only made the application of a DTM a far simpler process than before but also, because a fuller range of data could be applied, a more effective DTM was now attainable. Because the topography of Cornwall is generally hilly, DTMs were frequently required in order to achieve an acceptable level of accuracy in the mapping.

During this phase of the project, transcription procedures were as follows

- Set up a drawing in AutoCAD with a grid, standardised layers and OS map background as before (Appendix 1: 2.2)
- Select photographs for rectification
- Scan the photographs
- Manipulate scanned image if necessary with Corel Photopaint
- Prepare maps for AERIAL 5 (either by scanning the relevant area of map or by importing it as a Tiff file)
- Identify at least five control points on both map and photograph
- Rectify the photographs with AERIAL 5 to an acceptable level of accuracy, using a DTM where necessary
- Import the rectified photograph into AutoCAD
- Interpret and trace over archaeological features from the photograph in AutoCAD

- Scan photographs showing archaeological features which do not need rectification (see Appendix 1.2.1 for the relevant criteria) and interpret and trace them in AutoCAD as before (Appendix 1: 2.2)
- Convert the AutoCAD drawing to an Arcview shapefile and export to GIS (see Appendix 1: 2.4)
- Trace over the printouts to produce a final ink drawing on a translucent 1:10,000 map overlay

The final stage (producing ink overlays) was technically no longer necessary because GIS had superseded paper maps as the graphic record for both the HER and NMR by the late 1990s (Appendix 1: 2.4). The practice of producing ink overlays was continued for the sake of consistency until August 2003 when it was abandoned in order to save time and costs.

Block 9 (St Austell china clay area), Block 9B (Minions), Block 10 (North Cornwall Coast), Block 11 (Stratton and Bude), Block 12 (Southeast coast, Fowey to Looe), Block 13 (Bodmin to Liskeard), Block 14 (Torpoint and Saltash), Block 15 (Werrington, North Tamerton and Lewannick), Block 16 (Bodmin Moor), Block 17 (Isles of Scilly) and 5 map sheets from Block 8 (Redruth, St Agnes and Wendron) were transcribed using this methodology. In total this amounts to 92 map sheets.

2.4 Geographical Information System (GIS).

CCC acquired its Arcview GIS system in 1997 and has been developing it since then. Initially this was Arcview 3.2, later upgraded to Arcview 8, and currently Arcview 9.

Maps drawn using AutoCAD were exported as shapefiles to form a Vector layer on GIS. Between October 1998 and June 2000 project staff were unable to attach data (site ID numbers) to the shapefiles. In June 2000 the technique for achieving this was acquired and all features mapped since then have data attached.

Maps drawn as ink overlays before AutoCAD was introduced as part of project methodology were scanned by EH and are available as a Raster layer on GIS. The NMP Raster layer was automatically vectorised to an acceptable standard in September 2006, although obviously this layer has no data attached.

3 Data Processing

During the course of the project technological developments have altered some aspects of data processing methods.

3.1 Manual record

Map Note Sheet

Throughout the duration of the project a manual record of each map plotted was produced using a standardised Map Note Sheet (Appendix 8). The Map Note Sheet is a form containing checklists of air photograph and documentary sources indicating dates when these sources were consulted. The form also summarises the length of time taken to complete transcription and data recording for each map sheet.

Site Record Form

At the outset of the project until 1999, details of each site plotted, such as the date it was plotted, provisional interpretation, and, importantly, the serial number of the photograph on which it is visible, were recorded manually on a standardised Site Record Form (Appendix 6).

AutoCAD attached data tables

From 1999, the data which was previously recorded on Site Record Forms was instead attached to relevant AutoCAD drawing using a standardised table (Appendix 11).

3.2 Morph2 database

All individual sites and archaeological features plotted during the project were recorded in the Morph2 database. Morph1 was originally created as a means of recording cropmark features on aerial photographs in an objective way (Edis et al, 1989), but for the purposes of NMP was adapted as a means of recording all mapped sites regardless of whether they survive as cropmarks or upstanding features.

Morph2 contains geographical and interpretational data for each site and a classification based on the site's morphological characteristics. In the case of some site types, such as enclosures, this supplies a useful layer of data; because Morph is designed to be easily interrogated, it provides a means of site classification according to size and shape.

Morph2 also provides data relating to the operator's level of confidence in his or her interpretation of archaeological features. The database contains a *Validity* field which records on a sliding scale of 1 to 5 the level of confidence, with 5 being 'certain' and 1 being used to flag up 'potential' sites.

Another field records the quality of the source from which the mapped features have been derived. This field, *Source*, is arranged in a 0 to 5 sliding scale, with 5 representing data from wide scale excavation and 0 representing an existing plot of a site made from photographs (or other sources) which were not available to staff during the project. Level 1 on the scale represents 'poor quality photography', and level 2 represents 'good quality photography'; this is useful information in that there is less chance of misinterpretation of a feature recorded from good quality photography than one from a poor quality source.

Prior to the use of AutoCAD, Morph2 site ID numbers were recorded on the relevant Site Record Forms. All AutoCAD drawings are annotated with the Morph site ID number of each individual feature.

Morph numbers are also recorded on photocopies of the ink overlay drawings or on printouts of AutoCAD drawings.

3.3 Historic Environment Record

In addition to recording each site in Morph, data resulting from the project was input to Cornwall's HER. The main difference between HER and MORPH records is that the HER record contains a textual description outlining the relationships and archaeological context of a site.

If an HER record already existed for a site plotted as part of the project then that record was updated with text added to the site description, with the Morph ID number for the site, and with the serial numbers of the photographs on which the site is visible.

New HER records were created for previously unrecorded sites. The HER input form was simplified to reduce the time taken for record input, given the large amounts of data being incorporated as a result of the project (Appendix 8).

During the early part of the project, HER recording was done on a selective basis. Features such as isolated field boundaries, having already been recorded in the Morph2 database, were not seen as sufficiently archaeologically significant to warrant an HER record. Data from Blocks 1-3 and the five pilot sheets (49 map sheets in total) was recorded in this selective way.

Between July 1996 and November 1998, HER input was discontinued because transcription was regarded as the main priority in the face of uncertainty over continued project funding (Appendix 4). During this period, HER numbers continued to be allocated to sites and a backlog of HER records accrued, which was incorporated into

the HER in 2006. The backlog comprised 2,405 records from Block 3 (Fal estuary), Block 4 (Lizard Peninsula), and Block 5 (West Penwith).

On the resumption of HER input, in November 1998, it was decided that the previous selective approach was not rigorous enough in that it left too much to the discretion of individual team members, and was likely to result in an unpredictably impartial record. In the interest of consistency it was decided that every feature mapped should form part of an HER record, whether that be the amendment of an existing record or the formation of a completely new record. Blocks 4-17 (153 map sheets) were recorded in this comprehensive way.

All the ink overlays were inscribed with each site's HER number. From October 1998 onwards, HER numbers were attached to individual sites in the AutoCAD drawings, using standardise tables (Appendix 1: 3.1). After June 2000, this data was also exported in the Arcview shapefiles into the GIS. This means that by clicking on any given feature in the GIS layer, its HER number and summary record can be viewed on screen.

4 Post recording

4.1 Return of photographs

After completion of each stage of mapping, all photographs were returned to the original photo collection. In the case of photos loaned from the NMRC this was done at the completion of each block of map sheets, whereas with photos loaned from CCC Technical Support Service this was done on completion of individual quarter map sheets.

4.2 Data exchange

As each block of maps was completed, the original ink overlays were deposited at the NMRC in Swindon and copies retained at HES.

As each map sheet was completed two customised copies of the AutoCAD plot were made. One copy to be deposited at NMRC (formatted by removing the OS map background), and one copy to be exported to the CCC GIS with map background, Morph layer and grid removed.

A copy of the Morph2 database was deposited at NMRC.

Copies of all new and updated HER records resulting from the project were deposited at NMRC in order that this information be incorporated into the NMR.

5 Miscellaneous

Under this broad heading there are a number of important elements.

5.1 Progress meetings

Monitoring meetings between project staff and EH project officers were held on a regular basis. Their purpose was to monitor the ongoing progress of the work, exchange information and discuss issues affecting the project.

Annual progress meetings were held in conjunction with other NMP projects. The purpose of these was to report not only overall progress but also finds of particular archaeological interest, and to keep abreast of latest thinking and technological developments within the NMP nationally. Annual progress meetings were often attended by EH senior managers and offered an opportunity to raise the profile of the project.

5.2 Progress Reports

From 1999 onwards Annual progress reports were produced. These summarised progress and highlighted important aspects of the archaeology being recorded.

Throughout the entire project Quarterly reports were produced. These followed a set format and served as a monitoring tool, setting targets for the next quarter and recording whether targets had been achieved for the current quarter.

5.3 Training

Project staff received basic training at the National Monument Record Centre in aerial photo interpretation and the use of Aerial and Morph.

Project staff received basic and advanced AutoCAD training from consultant Simon Oliver of Northampton. Simon also provided training for the various AutoCAD upgrades. In addition Carolyn provided further AutoCAD training for both Andrew and Emma in-house at various stages of the project.

Further training not specifically for the project was provided by CCC. This covered Windows XP, Microsoft Outlook, Microsoft Power Point, and Health and Safety.

Some of the annual meetings contained a training element in topics such as twentieth century military archaeology.

6 Dissemination

The main dissemination of project results will form the publication phase of the project. This is currently at the project design stage.

During the lifetime of the project interim project results have been disseminated in a variety of ways.

HES Annual Review

Archaeology Alive is the title of the HES annual review. For each year of the project a summary of the year's work and a description of sites or themes of particular interest have been published the review.

Cornish Archaeology

Updates on the results of the project have been published as short notes in several editions of *Cornish Archaeology*, the journal of the Cornwall Archaeological Society.

Historic Environment Advisory Panel

This panel, which has been superseded by the Historic Cornwall Advisory Group (a panel with a different composition), met three times a year during the lifetime of the project. It was headed by the council member holding the Environment Portfolio and included representatives from other organisations with an interest in the environment, such as the National Trust, English Heritage, the District Councils, the National Farmers Union, Cornwall Wildlife Trust, and Cornwall Archaeological Society. Regular updates of results from the project were reported at meetings of the panel.

Royal Cornwall Show

Since 2001 the project has displayed an exhibition and had a pitch at the Royal Cornwall Show. This has always attracted a large amount of interest among the general public.

Professional and amateur society conferences

Presentations of the work of the project have been given at a number of conferences, both on a national and local level.

Website

CCC has had an on-line website since 2001. The project has maintained a regularly updated page on the site since its inception. Since December 2003 the project has also submitted contributions to the NMP web page on the EH website.

Appendix 2 Mapping strategy

1 Division of the project area in to working Blocks

In line with NMP guidelines the project area was divided into manageable working Blocks. In the original project design, there were 15 Blocks, with an average of 13 1:10,000 OS quarter map sheets per Block. There were also five pilot sheets designed to test timescale estimates over a range of geological and land use scenarios, and over a range of air photo and HER site density levels.

The original organisation of Blocks and their numerical sequence was established to reflect the mapping priorities at that time. During the course of the project these priorities changed and significant alterations were made both to the composition of the Blocks and to the order in which they were mapped. The revised programme is shown in Figure 6 and described below.

The order of mapping did not follow precisely the numerical sequence outlined below. During the latter half of the project three members of staff were engaged simultaneously in mapping. The working practice adopted was for individual team members to be responsible for mapping whole Blocks each. Depending on the size of each working Block and the complexity of the archaeology (which sometimes varied considerably from Block to Block), the order of mapping diverged from the numerical sequence on occasion.

Mapping of the Isles of Scilly was brought forward in the programme because of changing mapping priorities and was completed before Block 13; in the programme outline below it is still numbered as Block 17.

2 The working Blocks

Block 1 Tamar Valley

Block 1 comprises 12 map sheets covering the southern Tamar Valley. This was selected as the first area to be mapped (ahead of the pilot sheets) so that NMP data could be incorporated into the RCHME-funded Stratton Hundred Rapid Assessment Survey (Herring and Thomas, 1993) which was ongoing at the time of the mapping. This Block includes five map sheets straddling the Devon border.

Block 1 was mapped between January 1994 and October 1994.

The initial mapping output for Block 1.

- 12 ink drawings on 1:10,000 map overlays
- 12 pencil drawings on 1:10, 000 map overlays

Between June 2001 and January 2002, the Block 1 mapping was updated in AutoCAD as part of the West Devon Mapping Project (section 11.2) in order that all the mining districts in Cornwall were mapped to a consistent standard and were incorporated as Vector data in the GIS.

The mapping output from this update.

- 12 AutoCAD drawings
- 12 Arcview shapefiles with data attached

Pilot Sheets

Five pilot sheets were mapped. These were selected for a variety of reasons.

1. SX 07 SW was known to contain a large number of cropmark sites from aerial reconnaissance in the area.

2. SW 63 NE contained a large number of HER records for mining sites but there was little oblique aerial photo coverage.
3. SV 81 SE on the Isles of Scilly contained a large number of HER records but had very little photo coverage.
4. SX 17 NE was selected as typical of the Bodmin Moor area; there were a large number of sites and a large number of aerial photographs.
5. SX 05 SW was chosen to test timescale estimates for the china clay area.

The pilot sheets were mapped during October 1994 and April 1995

Mapping output for the Pilot Sheets.

- five ink drawings on 1:10,000 map overlays
- five pencil drawings on 1:10, 000 map overlays

Block 2 Camel Estuary

Block 2 consists of 16 map sheets covering the Camel Estuary. Previous aerial reconnaissance had shown this area to contain a high number of cropmark sites, making it a priority for mapping.

Block 2 was mapped between May and October 1995

Mapping output for Block 2.

- 16 ink drawings on 1:10,000 map overlays
- 16 pencil drawings on 1:10, 000 map overlays

Block 3 Fal Estuary

Block 3 comprises 16 map sheets covering the Fal Estuary and Roseland Peninsula. Previous reconnaissance had shown the Roseland Peninsula to be productive of cropmarks making it a priority for mapping. Mapping of Block 3 fed into the Fal Estuary Historic Audit Project (Ratcliffe, 1997), an EH-funded project which ran concurrently with the mapping.

Block 3 was mapped between November 1995 and July 1996.

Mapping output for Block 3.

- 16 ink drawings on 1:10,000 map overlays
- 16 pencil drawings on 1:10, 000 map overlays

Block 4 Lizard peninsula

Block 4 consists of 14 map sheets covering the Lizard peninsula. Originally programmed as Block 7 it was brought forward on the advice of the County Archaeologist on the grounds that it was an important, monument-rich upland area which (unlike West Penwith and Bodmin Moor) had not been subject to systematic archaeological survey.

Block 4 was mapped between August 1996 and June 1997.

Mapping output for Block 4.

- 14 ink drawings on 1:10,000 map overlays
- 14 pencil drawings on 1:10, 000 map overlays

Block 5 West Penwith

Block 5 comprises 19 map sheets covering the West Penwith Environmentally Sensitive Area (ESA). West Penwith was originally organised as two Blocks comprising

24 map sheets in total, and was programmed to be mapped late in the project. It was not regarded as a priority for mapping because a great deal of survey had been carried out in the area, including the West Penwith Survey of the 1980s, which was part-funded by EH.

West Penwith was brought forward in the programme on the advice of the County Archaeologist because a proposal was being planned for a monograph on the archaeology of the ESA; it was important that any additional data that the project might provide be available for the monograph. The bringing forward of West Penwith in the order of mapping resulted in significant knock-on changes to the overall programme.

Block 5 was mapped between October 1997 and February 1999.

Mapping output for Block 5.

- two AutoCAD drawings
- two Arcview shapefiles with no data attached
- 19 ink drawings on 1:10,000 map overlays
- 17 pencil drawings on 1:10, 000 map overlays

Block 6 Truro to Newquay landscape

Block 6 consists of 12 map sheets covering the central Cornwall landscape between Truro and Newquay. This area was originally programmed as Block 4; it was seen as a priority area because previous reconnaissance had identified a large number of cropmark sites. It was put back in the programme as a result of Blocks 4 and 5 being brought forward for the reasons outlined above.

Block 6 was mapped between November 1998 and November 1999.

Mapping output for Block 6.

- 12 AutoCAD drawings
- 12 Arcview shapefiles with no data attached
- 12 ink drawings on 1:10,000 map overlays

Block 7 Hayle and Camborne

Block 7 comprises 13 map sheets covering the area between Hayle and Camborne in west Cornwall and includes extensive mining remains. Both this and Block 8 were originally scheduled as a single, larger Block; Blocks 7 and 8 were completely reorganised from that original Block because of alterations made to the West Penwith Block.

The timing of the mapping of Block 7 enabled a significant amount of key data to be incorporated into the bid documents of the Cornwall and west Devon mining Landscape World Heritage Site (WHS) project.

Block 7 was mapped between August 1999 and June 2001

Mapping output for Block 7.

- 13 AutoCAD drawings
- seven Arcview shapefiles with HER data attached
- six Arcview shapefiles with no data attached
- 13 ink drawings on 1:10,000 map overlays

Block 8 Redruth, St Agnes and Wendron

Block 8 consists of eight map sheets covering the area from St Agnes in the north to Wendron in the south and including the Redruth conurbation. The archaeology of this area is characterised by extensive mining remains.

The timing of the mapping of Block 8 enabled a significant amount of key data to be incorporated into the bid documents of the WHS project.

Block 8 was mapped between November 1999 and August 2000

Mapping output for Block 8.

- eight AutoCAD drawings
- eight Arcview shapefiles with no data attached
- eight ink drawings on 1:10,000 map overlays

Block 9 St Austell China clay area

Block 9 comprises eight map sheets covering the Hensbarrow granite and the St Austell China clay area. This area was originally scheduled as part of a larger Block. It was brought forward in the programme so that the mapping of its mining remains could be incorporated into the bid documents of the WHS project. For the same reason it was redefined to exclude map sheets with no mining remains. In the event the mapping of Block 9 was delayed for a combination of reasons.

Block 9 was mapped between September 2002 and January 2006

Mapping output for Block 9.

- eight AutoCAD drawings
- eight Arcview shapefiles with HER data attached
- two ink drawings on 1:10,000 map overlays

Block 9B Minions

Block 9B consists of four map sheets around the Minions area of Bodmin Moor. The mapping of these four sheets was brought forward in the programme on the advice of the County Archaeologist. There are extensive well-preserved mining remains in this area and bringing it forward in the programme enabled mapping of the mining remains to be incorporated into the bid documents of the WHS project.

The creation of Block 9B necessitated a major reorganisation of the Blocks defined in the original programme.

Block 9B was mapped between March 2001 and March 2002.

Mapping output for Block 9B.

- four AutoCAD drawings
- four Arcview shapefiles with HER data attached
- four ink drawings on 1:10,000 map overlays

Block 10 North Cornwall coast

This Block consists of 14 map sheets covering the area to the north of Bodmin Moor and including the north coast around Tintagel.

This Block was altered as a result of a major reorganisation of the original programme for mapping Bodmin Moor (Block 16 below).

Block 10 was mapped between September 2000 and February 2002

Mapping output for Block 10.

- 14 AutoCAD drawings
- 14 Arcview shapefiles with HER data attached
- 14 ink drawings on 1:10,000 map overlays

Block 11 Stratton and Bude

Block 11 comprises 11 map sheets covering the north coast area around Stratton and Bude. It includes five map sheets straddling the Devon border.

This area was originally programmed to form part of two Blocks. Reorganisation was necessary to take account of the alterations to the mapping strategy for Bodmin Moor and the surrounding map sheets (Block 16 below).

Block 11 was mapped between February 2002 and November 2002.

Mapping output for Block 11.

- 11 AutoCAD drawings
- 11 Arcview shapefiles with HER data attached
- 11 ink drawings on 1:10,000 map overlays

Block 12 Southeast coast, Fowey to Looe

Block 12 consists of 10 map sheets located along the southeast Cornish coast between Fowey and Looe.

The Block was altered as a result of the reorganisations of the St Austell Mining District and Bodmin Moor areas (Blocks 9, 9B, and 16).

Block 12 was mapped between February 2002 and January 2003.

Mapping output for Block 12.

- 10 AutoCAD drawings
- 10 Arcview shapefiles with HER data attached
- 10 ink drawings on 1:10,000 map overlays

Block 13 Bodmin to Liskeard

Block 13 comprises eight map sheets covering the east Cornwall landscape between Bodmin and Liskeard.

Block 13 was altered as a result of the reorganisation of the St Austell and Bodmin Moor Blocks (Blocks 9, 9B, and 16). The map sheets forming this Block were spread over three Blocks in the original programme.

Block 13 was mapped between November 2002 and November 2003.

Mapping output for Block 13.

- eight AutoCAD drawings
- eight Arcview shapefiles with HER data attached
- two ink drawings on 1:10,000 map overlays

Block 14 Torpoint and Saltash

Block 14 consists of nine map sheets covering the coastal area in the far southeast of Cornwall, including the towns of Torpoint and Saltash. Two map sheets straddle the Devon border.

Block 14 was altered as part of the reorganisation of the St Austell and Bodmin Moor areas (Blocks 9, 9B, and 16).

Block 14 was mapped between October 2003 and July 2004.

Mapping output for Block 14.

- nine AutoCAD drawings
- nine Arcview shapefiles with HER data attached

Block 15 Werrington, North Tamerton, and Lewannick

Block 15 comprises 11 map sheets covering the border landscape between Werrington and North Tamerton and the north eastern part of Bodmin Moor. The Block includes four map sheets straddling the Devon border.

Block 15 was altered as a result of major reorganisation of the Blocks covering the Bodmin Moor area (Block 16 below).

Block 15 was mapped between October 2003 and December 2005.

Mapping output for Block 15.

- 11 AutoCAD drawings
- 11 Arcview shapefiles with HER data attached

Block 16 Bodmin Moor

This Block consists of five map sheets covering Bodmin Moor.

Final decisions on mapping strategy for Bodmin Moor were only reached after considerable debate during the course of the project. Because the moorland areas had been comprehensively surveyed during the Bodmin Moor project they were seen as a low priority for NMP mapping, hence their place at the end of the mapping programme. In terms of incorporating the surveyed area into a logical Block, however, there were difficulties because the moorland areas (the previously surveyed areas) do not lie within a convenient grouping of OS quarter map sheets.

In the original programme the surveyed area was divided between three Blocks. Reservations about this schedule were compounded by bringing forward mapping of the Minions area (Block 9B).

At the same time as the creation of Block 9B, the whole programme of mapping Bodmin Moor and surrounding area was reorganised. This reorganisation allowed a better focus on the areas of moorland previously mapped during the Bodmin Moor Survey. Parts of Blocks 9B and 15 also include surveyed moorland areas.

Block 16 was mapped between January and May 2006.

Mapping output for Block 15.

- five AutoCAD drawings
- five Arcview shapefiles with HER data attached

Block 17 Isles of Scilly

Block 17 comprises seven map sheets covering the Isles of Scilly.

The Isles of Scilly were originally scheduled to be mapped as Block 10. Very few photographs of Scilly were available and it was hoped that placing it towards the end of the programme would allow the opportunity for further flights. Because of revisions to the schedule, Scilly was put back to form the final Block of mapping.

During the summer of 2003 the Isles of Scilly Rapid Coastal Zone Assessment (RCZA) was initiated by EH. This was seen as an opportunity for project data to be incorporated into RCZA and this Block was mapped then.

At the same time, mapping of the pilot sheet SV 81 SE was updated by digitising the ink drawing in AutoCAD.

Block 17 was mapped between April and July 2001.

Mapping output for Block 17.

- eight AutoCAD drawings
- eight Arcview shapefiles with HER data attached
- eight ink drawings on 1:10,000 map overlays

Appendix 3 Resources and Programming

1 Project personnel

Over the 12 years during which the project ran, there was a remarkable continuity of personnel with very little staff turnover. All personnel involved in the project are listed in table 7 below.

Project personnel 1994 – 2006

Head of Aerial Survey (RCHME and EH)	Bob Bewley	1994 - 2004
	Pete Horne	2004 - 2006
Project co-ordinator (RCHME)	Carolyn Dyer	1994 - 1998
Project Officer (EH)	Bob Bewley	1998 - 2004
	Helen Winton	2004 - 2006
Project Manager (CCC)	Steve Hartgroves	1994 - 2003
	Andrew Young	2003 - 2006
Project team 1994 - 1998		
Archaeologist (CCC)	Andrew Young	1994 - 1998
Project team 1998 – 2001		
Archaeological Investigator (EH)	Carolyn Dyer	1998 - 2001
Archaeologist (CCC)	Andrew Young	1998 - 2001
Project team 2001 – 2005		
Archaeological Investigator (EH)	Carolyn Dyer	2001-2005
Senior Archaeologist (CCC)	Andrew Young	2001-2005
Archaeologist (CCC)	Emma Trevarthen	2001-2005
Project team 2005 – 2006		
Senior Archaeologist (CCC)	Andrew Young	2005 - 2006
Archaeologist (CCC)	Carolyn Dyer	2005 - 2006
Archaeologist (CCC)	Emma Trevarthen	2005 - 2006
Archaeologist (CCC)	Neil Craze	2006
Archaeologist (CCC)	Emma Ruddle	2006

2 Project team structure

The project was under the overall control of the head of Aerial Survey (EH) and throughout its lifetime was supervised and monitored by a Project Officer from EH (and formerly a Project Co-ordinator from RCHME). Mapping began in January 1994 and was carried out in the Truro offices of Cornwall County Council HES for the duration of the project.

January 1994 – October 1998

From 1994 until October 1998, project monitoring and co-ordination was carried out by Carolyn Dyer of RCHME, based in Swindon. Project management at HES was undertaken by Steve Hartgroves, Cornwall's HER Officer.

Between January 1994 and April 1995 the mapping was carried out by Andrew Young of CCC working part time. From April 1995 onwards he worked full time on the project.

October 1998 – January 2001

In October 1998 Carolyn moved to Cornwall to work on the project, whilst remaining an employee of RCHME (and of EH following the merger of 1999). From then until 2004, her role as Project Co-ordinator at RCHME (and Project Officer at EH after the merger) was taken over by Bob Bewley. During this period CCC project management continued to be carried by Steve Hartgroves.

These changes meant that the project team now consisted of two full-time interpreters. This team structure remained in place from October 1998 until January 2001.

January 2001 – January 2003

During this period EH project monitoring and co-ordination continued to be carried out by Bob Bewley, and CCC project management by Steve Hartgroves.

In January 2001, a third team member, Emma Trevarthen (nee Taylor), joined the project team as part of NMP Acceleration. From April 2001 there was a period of staff absence followed by part-time working.

Between June 2001 and January 2002 work on the project was suspended in order for the team to carry out NMP mapping in west Devon as part of the WHS project (see Appendix 4).

Thus between January and April 2001 the team operated with three full-time interpreters; between April and June 2001 it operated with two full-time interpreters; between June and August 2001 work was suspended; between August 2001 and January 2002 it operated with one part-time interpreter; between January 2002 and January 2003 it operated with two full-time and one part-time interpreters.

January 2003 – August 2004

During 2003 EH project monitoring and co-ordination continued to be carried out by Bob Bewley.

From early 2004 to the end of the project the role of project officer was taken over by Helen Winton of EH, based at Swindon. Overall control of the project was taken over by Pete Horne, the head of Aerial Survey at EH's York office.

CCC project management continued to be carried out by Steve Hartgroves until June 2003 when, owing to expansion at HES, the role of project manager was taken over by Andrew, who also continued to work as part of the mapping team.

In January 2003 there was a second period of staff absence, again followed by part-time working. Therefore during this phase of the project the team operated with two full-time interpreters from January to May 2003; from May 2003 until August 2004 it operated with two full-time and one half-time interpreters

August 2004 – August 2005

During this period EH project monitoring and co-ordination continued to be carried out by Helen Winton.

Between August 2004 and January 2005 there was another period of staff absence.

From January 2005 work on the project was suspended whilst the team carried out the North Devon NMP project (see section 11.2).

Therefore between August 2004 and January 2005 the project operated with one full-time and one half-time interpreters.

August 2005 – May 2006

During this period EH project monitoring and co-ordination continued to be carried out by Helen Winton.

Two temporary team members, Neil Craze and Emma Ruddle, were appointed in March 2006 in order to ensure input of the HER backlog (Appendix 4: 7)

The mapping of Cornwall and the Isles of Scilly was completed at the end of April 2006.

May 2006 – September 2006

Work continued on the input of the HER backlog, which was completed in September 2006.

Appendix 4 Project Management

1 Project funding

Funding from RCHME took the form of a series of grant payments. The first year of the project was funded by a single annual payment. In the second year, payments were six monthly; then quarterly. For the quarter April to July 1996, no funds were available and work on the project ceased. In July 1996 the grant payments resumed and continued until the merger with EH in 1999.

Following the merger, a revised project design was produced and a contract between CCC and EH drawn up. The contract included estimated total costs for completion of the project. These costs were met by a series of stage payments dependant on the achievement of agreed performance indicators.

Three further revised project designs have been produced over the course of the project reflecting changing circumstances and the development of working practices. In order to meet these changes and developments, additional funding has been sought through three variations to the project.

The timing and circumstances of these revisions to the project design and variations are outlined below in Appendix 4: 4.

2 Interruptions to the programme

Work on the project was suspended on three separate occasions.

The first of these was the three month period between April and July 1996 when no funding was available from RCHME. This amounted to 50 working days.

The second was between June 2001 and January 2002, when the project team was commissioned to carry out NMP mapping of an area comprising seven map sheets in west Devon (Taylor, 2002). This project was jointly funded by EH and Objective One and was undertaken as a direct result of the fact that NMP mapping of mining remains was providing a valuable dataset for the WHS project. The WHS project area extended into west Devon and it was important for consistency that the archaeology here be mapped to the same standard as in Cornwall. This project took 164.5 working days in total.

The third occasion was the 10 month period between January and November 2005, when the project team was commissioned by EH to carry out another NMP project in Devon (Young, 2007). This project was seen as a priority because of increasing pressure for land use change in parts of central and west Devon. This project took 286 working days in total.

These interruptions to the project amounted overall to 2.5 person years.

3 Changing staff circumstances

Over the course of the project there were four periods of staff absence, amounting to 291 days in total. Based on the CCC calculation of a working year = 200 days, this amounts almost 1.5 person years.

During the second half of the project some of the work was carried out on a part time basis. This amounts to a shortfall of 247 days in the number of working days anticipated in the revised project design of 1999.

As a result of periods of absence and part-time working, the overall shortfall in the number of working days anticipated in the various project designs amounts to 2.7 person years.

Given that the project spanned 12 years, none of these events is out of the ordinary, but none could reasonably be foreseen in the various project design stages.

4 Project designs and variations

In order to take account of the changing circumstances of the project there have been a number of revisions of the original project design, and a series of variation orders to meet the additional time and costs resulting from the changes.

Project design 1995

In the original Project design it was estimated that each map sheet would take an average of 6.5 days to complete. On this basis it was calculated that the mapping phase of the project would take 1,324 person days to complete, giving an end date of January 2001.

This estimate was based on the quantifiable number of photographs per map sheet and the number of existing HER records per map sheet. Vertical photo coverage contained in the NMRC collection was not quantifiable on a map by map basis so was not included in the calculation. The specification assumed that the project team would consist of one interpreter.

Revised Project design, August 1999

In August 1999, a revised project design was produced to see the project through to completion (following merger of RCHME with EH). This assumed that the project team would consist of two interpreters working full time.

By 1999 it was clear that the timescale projections in the original specification were over-optimistic (Appendix 4: 5 below). Therefore in the revised project design, timetable estimates were reviewed. New estimates were based on the average time taken to map all 89 map sheets which at that date had been completed (Young, 1999, 4.2). This approach had the advantage that associated non-mapping tasks were automatically included in the figures. In the revised project design it was estimated that each of the remaining map sheets would take 15 days to complete.

Based on timetable estimates in the revised project design a project end date of April 2005 was projected.

Second and third revised project designs, July and December 2000

During 2000 it was proposed by EH to augment the project team with a third interpreter as part of NMP Acceleration. A second revised project design was produced in July 2000 to take account of the implications of expanding the project team.

These were twofold: firstly the mapping would be completed sooner; secondly, because the third staff member was to be employed by CCC, more funding would have to be secured from EH. Two versions of this revision were produced, the first assuming that the third staff member would join the team in October 2000, the second that he or she would join in December.

In the event Emma was appointed to the post in December and joined the team in January 2001. This coupled with the fact that her actual salary level differed from that assumed in the 2000 revision meant that a third revised project design was needed and this was submitted in December 2000.

This revision also took into account an imminent period of staff absence. It did not, however, take into account subsequent part-time working because at the time, this was not anticipated. In this revision, the estimated end date of the project was brought forward by a year to June 2004, and a variation secured to meet the additional cost.

Fourth revised project design, April 2003

This revision was required because of timetable changes resulting from time spent on the west Devon NMP project, part-time working following staff absence in 2001, and from a second period of staff absence.

The revision also acknowledged that transcription was taking longer than previously estimated due to technological developments and the richness of the archaeological landscapes being mapped. Therefore in this revision, it was estimated that it would take 20 days (rather than the 15 previously estimated) to transcribe and record each map sheet.

These alterations had cost implications and a second variation was secured with a new project end date of June 2005.

Third project variation, July, 2005

A third variation to the project was required to take account of the postponement of the end date caused by the team working on the North Devon NMP project and by further staff absence.

As a result of this variation extra funding was secured and the project end date was put back to September 2006.

5 Project timetable

In the project design it was estimated that the mapping and database recording would be completed by January 2001. In the event the mapping phase was completed in May 2006, and database recording in September 2006. Clearly the outcome differed considerably from original estimates.

Apart from the unforeseen factors outlined above, there are three main causes of discrepancies between the anticipated and actual timetables.

4. Inaccuracy of original timetable estimates
5. Alterations to the methodology for mapping complex industrial landscapes
6. Effects of technological developments and alterations to working practices

Inaccuracy of original timetable estimates

In the original Project design it was estimated that the mapping and recording phase of the project would take 1,324 person days to complete. This gives an average of 6.5 days for mapping and recording each map sheet. This estimate was based on the quantifiable number of photographs per map sheet and the number of existing HER records per map sheet (Young, 1995A, section 8).

Depending on the density of photo coverage and the density of HER records, it was assumed that mapping would take from two days for the ‘quietest’ map sheets to ten days for the ‘busiest’, and that Morph recording would take from one day to five days. It was estimated that HER recording would take, on average, one day per map sheet.

In the event mapping and recording took on average 19.5 days per map sheet. Several errors in the original estimates can be identified.

- **The number of new sites anticipated was underestimated.** Estimates were based mainly on an appraisal of specialist oblique photographs held in the CCC collection. Sufficient consideration was not given to the number of previously unknown sites which might be visible on the large body of vertical prints available to the project. Without question the number of new sites recorded during the project far exceeded initial expectations (section 12.1) with obvious timetable implications.

- **Time for HER recording was underestimated.** Estimates were based on the (incorrect) assumptions of the number of new sites anticipated and the time taken to create records for these sites. Also the estimate made no consideration of existing HER records which would need updating. In the event HER recording took 3.8 days per sheet on average rather than the estimated one day.
- **Time for mapping previously surveyed areas was underestimated.** It was anticipated (Young, 1995A, 29) that map sheets covering West Penwith and Bodmin Moor, where previous survey had been carried out, would take half the time suggested for other map sheets with comparable photo coverage and site densities. The contribution of existing survey was overestimated; the average time taken to complete map sheets in West Penwith was 13.5 days (and this does not include time for HER recording [see Appendix 4: 7 below]), and Bodmin Moor 25 days.
- **Time for essential non-mapping tasks was not included in the estimates.** These tasks form an integral part of NMP projects. They include organising photographic loans into map sheet units, monitoring and progress meetings, dissemination via progress reports and presentations, management reports (such as revised project designs), training, enquiries from other professional bodies and the general public and other mandatory non-NMP tasks, such as HES meetings and attendance at conferences as part of continuing professional development. There are difficulties in quantifying time spent on non-mapping work (see Appendix 4: 6 below) but associated NMP tasks are likely to have used 20% of staff time and non-NMP tasks 10%.

Alterations to the methodology for mapping complex industrial landscapes

One of the most significant outcomes of the project is the detailed mapping of all visible archaeological remains of Cornwall's tin and copper mining industries. This mapping provided 40% of the data collated by the WHS project (section 12.3.2) as well as the starting point for numerous field surveys carried out by HES.

In the original project design it was specified that industrial remains would be mapped in a schematic way designed to indicate the presence and extent of the archaeology rather than to represent the archaeology in detail. During the course of the project it was recognised that detailed mapping would be of far more value to end users and the mapping strategy for mining remains was altered accordingly (section 6.2.1).

There is no doubt that the enhanced mapping of industrial remains increased mapping time for Cornwall's mining districts. This is difficult to quantify but the majority of map sheets for which mapping took more days than average contain extensive mining remains, and all map sheets for which mapping took 30 days or more contain extensive areas of mining activity.

Effects of technological developments and alterations to working practices

The two technological developments which led to significant alterations to working practices were the updating of AERIAL to version 5 and the use of AutoCAD for digital mapping (see Appendix 1).

AERIAL 5 enabled on-screen plotting from rectified photographs which was a major improvement on data input from a digitising tablet. However, other than a small amount of initial in-house training and a relatively short phase of familiarisation, the use of AERIAL 5 as the rectification software had no significant timetable implications.

Digital mapping in AutoCAD, on the other hand, undoubtedly increased mapping times significantly. However, this is difficult to quantify. In the revised project design of 1999 two days per map sheet was allocated for digitisation in AutoCAD. AutoCAD quickly

became the actual means of drawing rather than a stage in the transcription process and, as a result, it was included as part of transcription in the project time recording mechanisms rather than as a specific task.

For this reason, there are no reliable figures available for the time taken for AutoCAD digitisation per map sheet. As a rough guide, the first 80 map sheets completed were transcribed without AutoCAD; transcription of the next 80 map sheets took, on average, 3 days per map sheet longer. It should be stressed that these figures take no account of density of photo cover, density of visible archaeological remains, or any other factors which may have influenced transcription times.

If this guide is accurate, and AutoCAD digitisation took 3 days longer than previous transcription techniques, rather than the estimated two days, then for the 122 map sheets which were digitised in AutoCAD, 122 more working days than estimated might have been spent on their transcription.

6 Time recording systems

It is not possible to provide a reliable account of the amount of time spent on non-mapping tasks during the project. This is because for most of the life of the project, recording procedures for time spent on the various essential tasks were not sufficiently detailed to allow a reliable quantification for each of the work stages.

The two main elements of progress documentation are the quarterly reports and the Map Note Sheets. The quarterly reports recorded the total number of days spent by the project team for each quarter, but without any further breakdown. Map Note Sheets recorded time spent only on transcription and recording tasks for each map sheet. On the basis of these documents it is not possible to quantify the amount of time spent on essential non-mapping tasks which form an integral part of NMP projects.

For the period April 2002 to August 2003 time recording was undertaken using monthly progress reports. The format of these reports includes a fuller breakdown of all project-related work stages. For this period, 71% of project time was spent on transcription and recording, 11.5% on reports and outreach, 4% on meetings, 4% on cataloguing photographs, training and dealing with enquiries, and 9.5% on ‘other duties’.

Reports and outreach includes preparation of annual reports, preparation of presentations, and preparation of revised project designs. ‘Other duties’ include HES meetings, computer upgrades, and attendance at conferences.

In the absence of other detailed documentation these figures must serve as a guide to the amount of time spent during the project as a whole on transcription and recording (70%), associated NMP tasks (roughly 20%), and non-NMP tasks (10%).

7 HER backlog

At the beginning of the project it was agreed with RCHME that data resulting from the mapping would be incorporated into the county HER. Records were to be created for new sites, and existing HER records updated. For the first two years of the project site recording proceeded according to this specification.

During late 1995 and in 1996, however, uncertainties arose over RCHME funding. Grants went from being six-monthly to quarterly, and for the quarter of April-July 1996 no funds were available. Funding was resumed but it was now uncertain whether the project would be funded to completion. With this in mind HER input was suspended in order to save time to ensure that as much as possible of the project area would at least be mapped.

Input of data to the HER was seen as an important element of the project. For this reason, following the merger of 1999, EH agreed that HER input should be resumed and that input of the backlog that had accrued since 1996 should form part of the

project (Young, 1999). The backlog consisted of 2,405 records covering 45 map sheets and was timetabled to be input following the completion of Block 9.

In the event the backlog was input between March and September 2006.

Appendix 5 Aerial photographic loans from the National Monuments Record

Mapping Block	Loan Reference no	No of Photographs
Block 1	JEW 9421312	1,574
Pilot sheets	CA 945241	1,075
Block 2	JEW 9411 1081	1,496
Block 3	JEW 958602FB	2,277
Block 4	9632013	1,759
Block 5		
5A	57697	1,407
5B	3943 9899	519
Block 6	?	2,506
Block 7	11600 9899	1,766
Block 8	13000 9899	1,348
Block 9	80353 and 33944	975
Block 9B	210900001	2,095
Block 10	36000 0102	1,829
Block 11	37541 0102	1,286
Block 12	37542 0102	1,739
Block 13	46515 0203	2,466
Block 14	58971	3,340
Block 15	80351	1,236
Block 16	62418 and 62418B	1,993
Block 17	57173	339
Total number of photographs loaned		**33,025**

Appendix 6 Project Site Record Form

ROYAL COMMISSION ON THE HISTORICAL MONUMENTS OF ENGLAND

APU SITE RECORD FORM

SITE LOCATION

NGR			BLOCK		MAP	
COUNTY			PARISH			
NAR REF.			SMR REF.			

FORM	C	E	S	C&E	C&S	E&S	C&E&S

INTERPRETATION	VALIDITY	
	1-5 (SEE MORPH MANUAL)	

COMMENT

MAPPING METHOD	AERIAL		SKETCH	

DIGITISED SOURCE

PHOTOGRAPH(S)	DATE

GRAPHICAL SOURCE

PHOTOGRAPH(S)	DATE	PHOTOGRAPH(S)	DATE

LOCATION	RIDGE	HILL-TOP	SLOPE	PLATEAU	PROMONTORY	FLAT	VALLEY-FLOOR	VARIOUS
ASPECT	N	NW	W	SW	S	SE	E	NE	ALL
STILL EXISTING					SOURCE			

	INTERPRETATION	CHECK
AUTHOR		
DATE		

COMMENTS:

Appendix 7 Map Note Sheet

NATIONAL MAPPING PROJECT - MAP NOTE SHEET

Cornwall and Isles of Scilly Mapping Project

Block No:	Map sheet:	Author:

Sources Check List - enter dates main consultation completed

Archival Source	Date		Photo Source	Date
MONARCH			NMR Air Photos obliques	
NAR record map			NMR Air Photos verticals	
Excavation Index			CUCAP/ULM	
SMR			SMR	
SMR record map			CCC	
OS 1st Edition map			Other (please state	
Quantification assessment				
Other (please state)				

Progress	Date	Days
Transcription commenced		
AutoCAD fair drawing		
MORPH input commenced		
SMR recording completed		
Total Days		

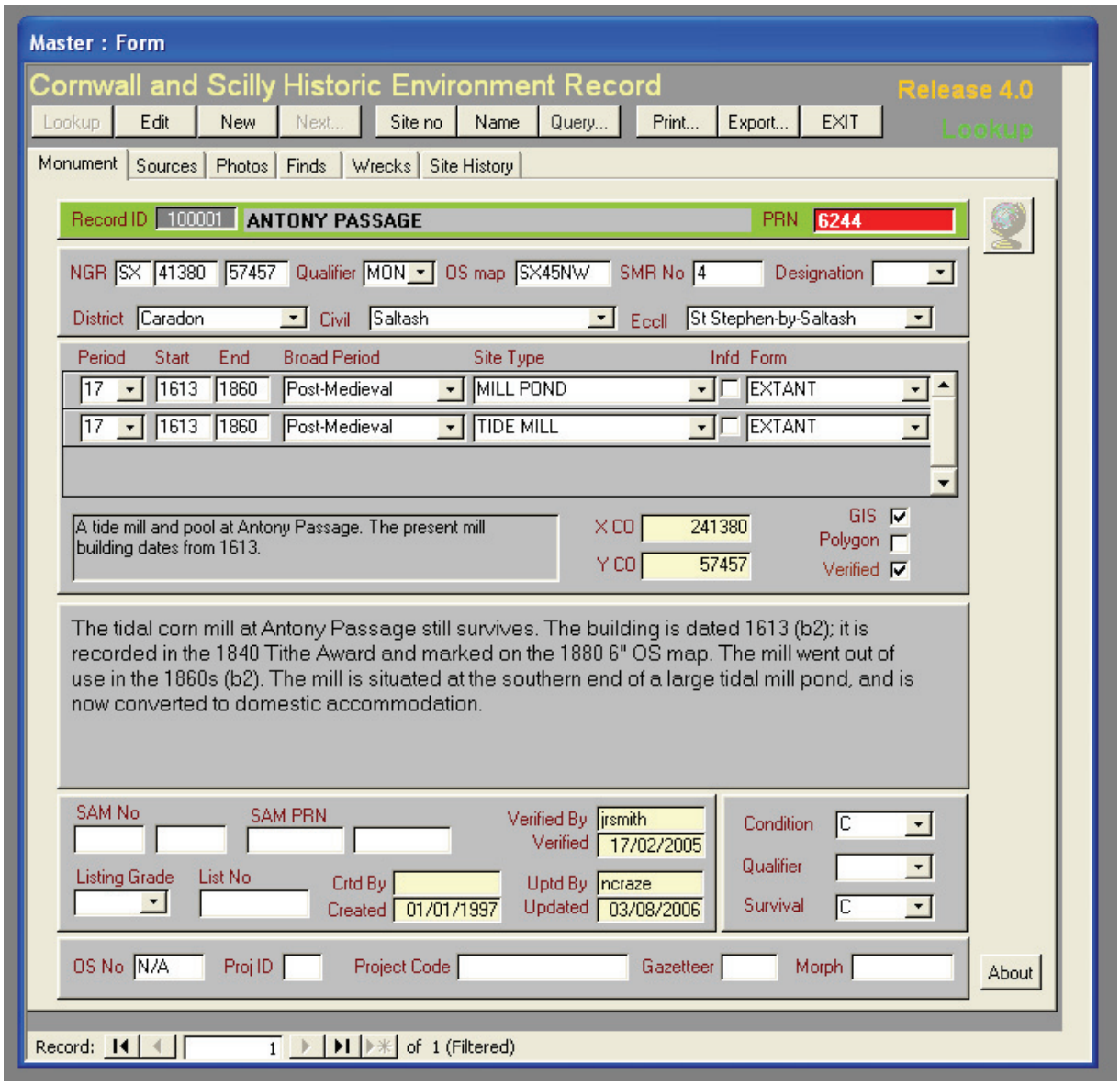
Project Database	Number of
MORPH records	
Updated SMR	
New SMR records	

Illustrative Photographs:

References:

Comments:

Appendix 8 Sample Cornwa ll County Council HER record form



Appendix 9 S tandardised mapping conventions for NMP line drawings

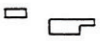
APPENDIX 5 MAPPING CONVENTIONS

Ditches: extant or plough-levelled. Variable line thickness

Leat, mill race: Arrow indicating direction of flow if known. Variable line thickness. (larger artificial water courses as ditches).

Stone and/or earth banks/mounds: extant or plough-levelled. Heavy stipple. Applies also to lynchets, other artificial slopes and wall foundations (not buildings).

Buildings. Unroofed.



Holloways and unsurfaced trackways: not defined by other depicted features. 1mm dashes. Single line per track when braided.

Railway/tramway: 2mm spacing for cross-lines. This convention should be used even if the only visible remains are embankments/cuttings.

Compacted or made stone surfaces/spreads: Medium stipple. (e.g. paved area, surfaced road, dressing floor).

Area features (small): (e.g. storage pits, grubenhauser, clearance cairns, standing stones) Drawn solid as seen (pit alignments can be stylised). Extant negative features should be drawn with "T" hachures if possible.

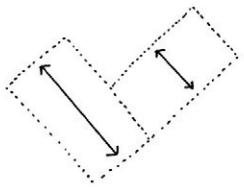
Negative features (large): extant or back-filled (0.5mm "T"). (e.g. quarries, fish ponds) Depict as solid if too small to hachure.

Spoil/waste dumps: (1mm dashes at 0.5mm spacing enclosing light stipple). (e.g. mining spoil heaps, saltern mounds) Applies to extant and levelled features. (On large features a 3mm band of light stipple within the dashes will suffice).

Extent of feature: (1mm dashes at 0.5mm spacing). A "hard" boundary marking the outline of a feature (e.g. used to outline runways of a disused airfield).Only use this when other conventions are inappropriate.

Pits or shafts: Including bell pits defined by a "doughnut" of spoil.

Ridge and furrow: Units are defined by dots (1mm spacing) if not bounded by headlands, banks or ditches or any other feature which has a specific convention. Double arrow to show shape and direction of rig.



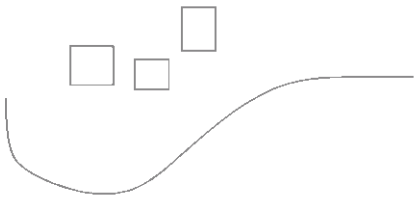
Extent of area: (3mm dashes at 1mm spacing. Use .25 pen). A soft boundary marking the perceived limit of an activity (e.g lead mining area)

Appendix 10 S tandardised AutoCAD mapping conventions

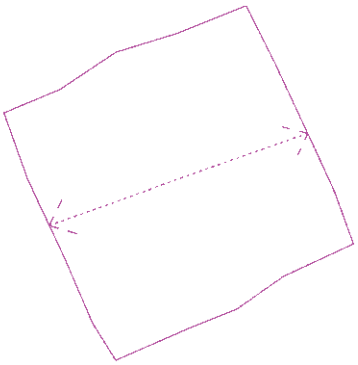
All cut features e.g. Ditches, hollow ways pits etc. (Using Ditch layer in AutoCAD)

Earthwork or Cropmark Banks (using Bank and Bankout layers in AutoCAD)

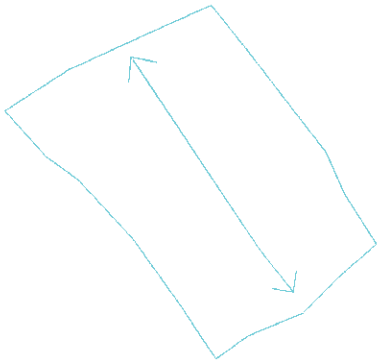
Buildings, walls etc. (Using stonework layer in AutoCAD)



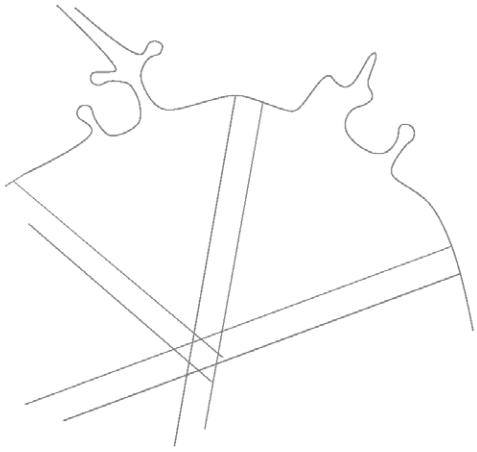
Ridge and furrow see as cropmarks, or seen as earthworks and known to be ploughed level (Using the Rigdotslevel and Rigarrlevel layers in AutoCAD)



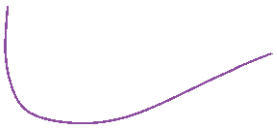
Ridge and furrow seen as earthworks on the latest available aerial photographs (Using the Rigdotsewk and Rigarrewk layers in AutoCAD)



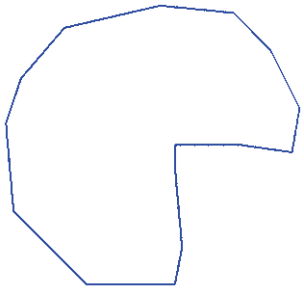
Large area features, such as airfields, depicting the extent of the feature (using the Extent of area layer in AutoCAD), and the main features (using the Structure or Stonework layers in AutoCAD).



Railways and tramways (using the Tramway layer in AutoCAD)



Large cut features, such as quarries, ponds (using the Large cut feature layer in AutoCAD)



Appendix 11 AutoCAD Attached Data Tables

RECORD:

Field	PRN	enter Cornwall or Isles of Scilly HER PRN number
	AMIE Hob UID	enter AMIE Hob UID

INDEX:

Field	PERIOD	enter date e.g. BRONZE AGE
	TYPE	enter monument type e.g. ENCLOSURE
	EVIDENCE	enter form e.g. CROPMARK
	PHOTO REF	enter photo reference which feature was plotted from
	PHOTO DATE	enter date of photo reference (DD-MM-YY)
	COMMENT	any other information which may aid later analysis will be recorded in this field

SURVEY:

Field	AUTHOR	enter author e.g. Carolyn Dyer
	DATE	enter date e.g. 6th September 2004
	SCALE	enter given scale of OS mapping used for plot e.g. 1:10,000
	LEVEL	enter level of survey e.g. 2
	COPYRIGHT	enter copyright holder e.g. EH/Cornwall CC

Appendix 12 AutoCAD Layers

Layer name	*Colour*	*Linetype*
BANK	1 (red)	ONTINUOUS

Outline of broad banks and thin banks defined by a single line.

BANKFILL	1 (red)	CONTINUOUS

All bank outlines (created on "bankout" layer) will be filled with stipple, "dots", at a scale of 2.25 and an angle of 53 degrees. Thin banks will also go on this layer as a single line

DITCH	3 (green)	CONTINUOUS

All features seen as ditches, including small area features e.g. ponds and pits

DITCHFILL	3 (green)	ONTINUOUS

Solid fill

EXTENT OF AREA	8 (grey)	DASHEDX2

Used to depict the extent of large area features e.g. airfields, military camps, mining/extraction

GRID	7 (white)	CONTINUOUS

Grid at 1km intervals equivalent to one OS 1:10,000 scale quarter sheet.

INDUSTRIAL EXTENT	30 (orange)	DASHEDX2

Used to depict the extent of mining and other industrial remains where individual features are not clearly visible. (HES drawings only. Move features to Extent of Area layer for the NMR version)

MILITARY FEATURE	161	CONTINUOUS

Used for twentieth century military installations (pillboxes, radar stations, etc). Used for HES drawings only. Move features to Structure layer for the NMR version)

MORPH	130	CONTINUOUS

Used for annotating drawings with Morph numbers (text height = 12)

RIGARRLEVEL	6 (magenta)	ISO03W100

Arrow depicting direction of rigs in a single block ridge and furrow, seen as earthworks or cropmarks, but known to have been ploughed level.

RIGARREWK 4 (cyan) CONTINUOUS

Arrow depicting direction of rigs in a single block of ridge and furrow seen as earthworks on the latest available aerial photographs.

RIGDOTSLEVEL 6 (magenta) DOTX2

Outline of a block of ridge and furrow, seen as earthworks or cropmarks, but known to have been ploughed level.

RIGDOTSEWK 4 (cyan) DOTX2

Outline of a block of ridge and furrow still surviving as earthworks on the latest available aerial photographs.

SHEET 7 (white) CONTINUOUS

Used in conjunction with printing macros.

SPOILHEAP 30 CONTINUOUS AR-SAND (0.2)

Stipple for spoil heaps. Used for HES drawings only. Move features to Bank layer for the NMR version

SPOILHEAPOUT 30 ACAD_ISO2W100

Dashed outline for spoil heaps (replicating ink conventions). Used for HES drawings only. Move features to Bankout layer for the NMR version

STONEWORK 8 (grey) CONTINUOUS

Used to depict exposed stonework e.g. walls, cairns, standing stones and could be used for building platforms that are concrete.

STRUCTURE 9 (grey) CONTINUOUS

Used to depict features which do not easily fit into other categories because of their form, e.g. tents, radio masts, painted camouflaged airfields

TIMBER 40 CONTINUOUS

Used to depict wooden features such as wrecks

TRACKWAY 40 ACAD_ISO03W100

Used to depict trackways (mainly used for post medieval/modern industrial-related trackways). Used for HES drawings only. Move features to appropriate layer (usually bank or ditch) for the NMR version

TRAMWAY 200 (purple) TRACKS

Used to depict tramways mainly associated with industrial areas

VIEWPORT 7 (white) CONTINUOUS

Used in conjunction with the printing macros

If you would like this document in a different format, please contact our Customer Services department:
Telephone: 0870 333 1181
Fax: 01793 414926
Textphone: 01793 414878
E-mail: customers@english-heritage.org.uk