

CASE STUDY 3C – HASTINGS, UK

Case study area: Hastings, UK.

Main geomorphological types: Soft cliffs, sand and shingle beaches.

Main coastal change processes: Cliff erosion and instability, beach change.

Primary resources used: Art, archaeology, maps and charts, photographs.

Summary: The cliffs at the eastern end of the Hastings frontage are subjected to coastal erosion and instability. The main beach is affected by erosion processes and sediment accumulation and depletion. A combination of historic paintings, maps, charts, photos and archaeological data has demonstrated the long term changes in terms of erosion and sediment levels.

Recommendations: Coastal managers should use these resources to understand the long term changes, in particular where humanly-made structures (the harbour arm) have influenced the sediment regime. These resources provide hundreds of years' worth of data which can contribute to ongoing monitoring of the coast and modelling for future change.

Coastal managers face an ongoing battle to moderate impacts from the sea in the face of a changing climate and pressures from human use of the coastal zone. The challenges that lie ahead are forecast to increase while resources are being forced to go further.

This case study report is part of the Arch-Manche project, which quantifies the value of under-used coastal indicators that can be applied as tools to inform long term patterns of coastal change. In addition, it provides instruments to communicate past change effectively, model areas under threat and interpret progressive coastal trends.

Hastings is one of six UK case study areas for the Arch-Manche project. This report section introduces the study area and why it was chosen as part of the project, the results of the archaeological and palaeoenvironmental study are then presented along with the results of the art study. The analysis of these results and the potential for demonstrating the scale and rate of sea level change are then presented. For further details about the project and the methodology see [Section 2](#).

Within the Hastings area the archaeological and palaeoenvironmental resource and the available art resource have been researched, ranked and analysed. The extents of the detailed study areas are shown in Figure 3C1 below. The area considered for archaeology and palaeoenvironment has been selected to provide a representative range of types of evidence across a range of periods spanning from Palaeolithic through to more recent coastal heritage. The art, photograph and map case study area encompasses a broader stretch of the coastline to reflect the various coastal morphologies and features which have been depicted over time.



Figure 3C1. Map of the Hastings Study Areas. The dotted line is the extent of the archaeology area and the red square is the extent of the art area.

3C.1 Introduction to the Hastings Study Area

The historic town of Hastings is situated on the coastline of East Sussex, approximately 16 miles (21km) to the east of the large seaside town of Eastbourne. The study area comprises Hastings main beach, and the beach and cliff line to the east of the seafront.

3C.1.1 Geology and Geomorphology

Hastings is situated on the south coast facing the English Channel, and lies within the wider geological structure of the Wealden Dome of Kent and East Sussex. The coastal geology in this area is comprised of the Hastings Beds, named after the locality, which, geologically, lie beneath the Lower Cretaceous rocks of the Wealden Clay and the Lower Greensand. These are in turn overlain by the Gault and Upper Greensand and the Chalk, which outcrop to the east and to the west.

Essentially the cliffs on the Hastings frontage, extending east towards the village of Fairlight, are composed of weak clays, siltstones and sandstones of the Lower Cretaceous, which form a high but unstable cliff line that is prone to coastal erosion at the toe; the frontage is also affected by cliff face weathering and instability problems. Sea spray and groundwater, together with a reduction in horizontal stress due to erosion, causes softening of the clay sections of the cliffs to take place. Joints in the overlying rocks open and blocks rotate and move forward as secondary toppling takes place.

Eventually massive siltstone blocks break away from the cliff, causing a loss of support to the overlying blocks, which will also eventually fall into the sea. The talus or debris at the base of the cliff is quickly removed by the sea, enabling the process to initiate once more. The eroding sandstone cliffs contribute to the sedimentary system and the material is carried along the coast

by the process of longshore drift. Fronting the town of Hastings, the beach is composed of shingle in its upper part with an extensive sandy foreshore.

3C.1.2 Summary of the Archaeology and History of the Study Area

Early Prehistory

The shoreline of Sussex underwent several changes during the Palaeolithic period as ice ages affected sea levels. At some periods the sea level was anywhere between 8 metres and 40 metres above the present day sea level, whilst at times of lower sea level Sussex was connected directly to mainland Europe (Rudling, 2003: 1-2). It is likely that groups of hunter-gatherers travelled across the area of modern day Sussex when conditions became habitable again following the last Ice Age, around 11,000 BC. The Holocene sea level rises caused by thawing ice caused large lakes in the area of the North Sea to breach, eventually flooding the river valley between Britain and France and creating the English Channel. After this, sea levels along the Sussex coast continued to rise, before stabilising in the Neolithic period (Rudling, 2003: 2). The exact rate of sea level change would have been affected by a variety of factors; particularly the topology and geology of the land surfaces at different points along the coast (which vary from chalk ridges to peat bogs) and the rate at which the south east of Britain was 'sinking' as the land mass of Great Britain geologically 'tilted' (Rudling, 2003: 2).

The precise extent of the coastline in the Palaeolithic, Mesolithic and Neolithic periods is open to some debate. Certainly during the Palaeolithic, any shoreline sites in the vicinity of the study area most likely lay somewhere nearer to the centre of the present day English Channel than the Sussex coast. To date, their presence has only been suggested by the recovery of flint axes and barbed harpoon points dredged from the seabed. The area of the present day coastline would have been several miles inshore during the Late Upper Palaeolithic and Mesolithic periods; as a result freshwater conditions in the river valleys would have encouraged peat and other organic material to flourish. This is particularly true in the Pett Levels to the east of Hastings, where some 11m of organic sediments have been recorded offshore, representing a build-up of organic matter over 10,000 years (Rudling, 2003: 2).

There are therefore, few Palaeolithic records in the study area; only three find spots are identified in the Hastings locality. Conversely, there is a lot of activity identified in West Sussex particularly along the old shoreline at Boxgrove (Rudling, 2003: 24). Much the same is true in the Mesolithic period, with identified sites tending to be dominant in the west and only a few within the study area. Flintwork suggests there may have been a settlement around the present day site of the castle (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

Later Prehistory

This trend of increased activity in the west continues into the Neolithic period; it is likely that the coastline may not have reached close to its current position by this time. The South Downs dominate western Sussex and it was here that Neolithic peoples began to settle in the landscape. There are no identified cursus', causewayed enclosures or other signs of industry or settlement in East Sussex, despite the plethora of such sites to the west. Neolithic Pottery has been recovered from East Hill and the site of the present day castle. Stone axes have been found at Fairlight and other flint tools have been found in the Bourne Valley, indicating at least the presence of Neolithic communities in the area at this time (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

During the Bronze Age, it is likely that the sea level was still several metres below its present day level. Research at the Pett Levels to the east of the study area suggests that a prehistoric

forest dominated the coastline (Rudling, 2003: 6, 11). This is most likely the same forest that stretched right across the study area's coast to Bulverhythe and Little Galley Hill, and onto the hills inshore (Hastings Chronicle, 2014: Key Events – The Origins of Hastings). During the driving of piles for Hastings Pier in 1872, huge tree trunks were discovered embedded beneath a layer of clay. One of these; a two ton 7.3m by 1m trunk had to be removed and was displayed in Alexandra Park for a number of years. It is presumed that it was part of the Bronze Age forest that ran along the shore (Hastings Chronicle, 2014: Hastings Pier). Elsewhere metal axeheads and a probable barrow on East Hill suggests activity in the area (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

By the Iron Age the coastline was most likely beginning to assume a familiar shape, although it may well have still been slightly offshore of its present day location in the study area. The first confirmed settlements at Hastings date from this period (although they are not to be taken as an indication of continual subsequent occupation). A large Iron Age hillfort was constructed on East Hill and there was almost certainly another on the site of the present day castle on the west side of the Bourne Valley. Although inland, they would have had a dominant view of the English Channel (Rudling, 2003: 4). Excavations at Beauport Park have suggested a pre-Roman round-house may have existed here (Wealden Iron Research Group, 2014), and it is possible that iron extraction and working was taking place at this site long before the Romans arrived. If this is the case, it is possible that the settlements at Hastings were already doing a brisk trade with Gaul and the Roman Empire before 43 AD.

Roman Period

The Roman 'invasion' of 43 AD may have resembled a peaceful take-over or even liberation in areas like Sussex, where there is little evidence of conflict or defences to oppose them. A 'client' kingdom was quickly established in Sussex. A new king, loyal to the Romans, quickly established Roman influence in the area (Rudling, 2003: 111-112).

Although a number of Roman settlements developed along the south coast (such as at Pevensey to the west and in Kent to the east), there is no archaeological evidence of any settlement at Hastings. A number of findspots have suggested some Roman presence in the study area, but many of these are poorly recorded. The suggestion of a Roman camp on East Hill is confirmed only by the presence of a coin hoard and an undated earthworks (Fradley & Newsome, 2000: 4). However, there is the possibility of a substantial, but as yet unrecorded, Roman presence in the area (Fradley & Newsome, 2008: 26).

Although outside of the study area, Beauport Park, three miles from present day Hastings town centre, shows that Roman industry was based nearby. Within these grounds, excavation has revealed a substantial amount of Roman remains, including a bath-house and substantial iron works (Open University, 2006: Beauport Park). This is believed to be the third largest iron works in the Roman Empire and iron will have been traded back into Europe. It is possible that a natural harbour at Hastings could have been used for such a purpose; the Classis Britannica (Roman fleet) would have been ideally situated to control the Channel and exports of this iron (Rudling, 2003: 227), but the absence of significant structures in Hastings itself means that this remains conjecture (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

Medieval Period

With the withdrawal of the Romans, Britain fragmented into a number of separate Kingdoms. The area of modern day Sussex was originally the Kingdom of Suth Saxe (South Saxons) but Hastings appears to have been a separate territory and kingdom of the Haestingas tribe. Raids by other nations were a constant risk on the south coast and it is recorded that King Offa of

Mercia defeated the Haestingas tribe in a battle near Hastings in 771. However, it may have continued to exist as a separate province within Sussex until the 11th century (Rudling, 2003: 159). This separation may have been a result of the relative isolation caused by the Pevensey Levels to the west, Romney Marsh to the east and the Forest of Weald to the north (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

Hastings Castle almost certainly had pre-Norman conquest origins. It is often claimed that a reference to a castle at Hastings in the 10th century Burhal Hidage actually refers to upgraded works at the Roman fort at Pevensey (Pevensey Castle), but it seems likely that a Motte and Bailey Castle already existed on the hilltop at Hastings when William the Conqueror arrived (Rudling, 2003: 157). This would itself have been built on the site of the supposed Iron Age promontory hillfort (Fradley & Newsome, 2008: 25). The first settlement in the location of present day Hastings probably began in the 9th century. Whether this was centred in Priory Valley (the land to the west of Hastings Castle) or the Bourne Valley (to the east of the castle, the area known today as the Old Town), is uncertain. However it is most likely that the town was a favoured port; a natural harbour that was ideally placed for cross Channel trade (the Stade beach in front of the Old Town comes from the Saxon term ‘landing place’). However the shingle harbour will have been prone to coastal movement and another port was established at Bulverhythe (meaning ‘harbour of the borough’) (Hastings Chronicle, 2014: Key Events – The Origins of Hastings).

Shortly after his arrival in Britain, William ordered the castle reinforced and by 1100 AD it was a Rapal Castle, the centre of the Rape of Hastings (Rudling, 2003: 173), an administrative area that predated the Norman Conquest and was gifted by William to his cousin Robert, Count of Eu (Sussex Castles, 2014: Hastings Castle). At the peak of its development it had a stone keep and a church inside its outer earthworks. The castle would have been important to the defence of the harbour, especially as its prestige increased with the development of the Cinque Ports. In 1216 it was partially dismantled on the orders of King John, but he later took possession of the castle and refortified it (Hastings Chronicle, 2014: Key Events 771-1699).

The establishment of the Cinque Ports in 1155 AD was extremely beneficial to Hastings, one of five towns ports that was given generous tax exemptions and trading rights in exchange for being on hand for military action in the event of a war (the other four being New Romney, Hythe, Dover and Sandwich). With these privileges Hastings flourished, as did its subsidiary (or ‘limb’) ports of Winchelsea, Hydneye, Pevensey, Northeye, Seaford, Bekesbourne, Grange, Bulverhythe and Petit Iham (The Cinque Ports, 2014: Limbs – Past and Present).

Hastings’ success as a port was owed to its excellent natural harbour, but in 1287, a great storm, the last of several violent storms that century, battered the town. As well as destroying the natural harbour the storms caused part of the castle and keep to collapse into the sea. It may have also flooded Hastings town and caused it to subsequently be built on a new layout in the Priory Valley (now known as the Old Town) (Hastings Chronicle, 2014: Key Events 771-1699).

French forces twice attacked Hastings in the 14th century, causing damage to the castle and sacking the town. The castle was reinforced after the first raid of 1339 and significantly, some of the oldest houses still extant in the old town date to this period, suggesting that the sacking necessitated rebuilding the entire town (Hastings Chronicle, 2014: Key Events 771-1699). The second raid of 1377 was also very destructive; it caused substantial damage to the castle (which was not repaired) and town and made it into a small and weak port. A wall built along the

seaward side of the old town in 1385 may have been to slow the rate of coastal erosion or as a military defence against French raiders (Hastings Chronicle, 2014: Key Events 771-1699). Hastings now consisted of a small town built along two roads running to the shore between the castle and East Hill, and would remain much the same until the mid-18th century.

Post-Medieval Period

By the 16th century, Hastings' natural harbour had by this time silted up entirely. In 1596 and again in 1597 efforts were made to construct a stone pier that could resist the weather and shelter a mooring area. Both were destroyed by the onset of winter (Rudling, 2003: 12). The remains of the piers, consisting of exposed timbers and a scatter of rocks, were still visible and recorded in 1833 (Rudling, 2003: 228).

Despite these setbacks, a fishing fleet continued to operate from Stade Beach in front of the town. The fishermen worked a two season routine; in the first half of the year, they would head west to catch mackerel, and in the second half of the year they would fish for herring in the North Sea. A series of huts were built for storage; it is believed that the huts date back as far as the 16th century, although they have almost certainly been rebuilt a number of times. The present layout dates from the 1830s when new regulations decreed that they may not be more than eight feet square. Many of them were thus made as tall as possible to provide the maximum amount of storage on a small plot of land. Some 109 were recorded in the 1830s, but only 45 remain in use today.

Until 1855, Hastings Council refused to construct any shore defences in front of the Old Town. This was partly an effort to force the fishing fleet to relocate, but when storms in 1882, 1883 and 1884 caused damage to the town, they were forced to build a groyne that was completed in 1887 (Hastings Chronicle, 2014: Key events 1850 - 1899). In 1896, work started on a new harbour in front of the Old Town. Insufficient funds and the presence of a prehistoric riverbed some 250m offshore, meant that the harbour was not completed. Instead, one arm of it was left sticking into the sea. By 1902, the idea of a harbour had been abandoned entirely and no further work has taken place since. The wall remains, despite regular battering from the sea, and has offered a degree of protection to the fishing fleet based on the Stade beach.

Hastings Pier was first conceived in the 1860s; work began in 1869 and it was opened to the public in 1872. The pier is 278m long and had a large pavilion at its seaward end. This was destroyed by fire in 1917 but rebuilt in 1922 and additional landing stages and landward pavilions were added to the pier over its lifetime (National Piers Society – Hastings, 2014). The success of the pier led to a rival pier and promenade being constructed further west at St Leonards. Begun in 1888 and completed in 1891, this pier had its principal pavilion at the landward end and a landing stage at the seaward end. This was washed away in an 1896 gale and had to be replaced (Hastings Chronicle, 2014: St Leonards Pier).

Despite the apparent vulnerability of the beach at Hastings, few significant anti-invasion defences were built in the study area in this period. The nearest Tudor 'Device Fort' was Camber Castle at Rye, although there may have been many less significant and unrecorded batteries all along the south coast. It is believed that the coastal wall between the ruined castle and East Hill was rebuilt in the 1540s; if this is the case, the remains extant today most likely date from this period and not the 14th century (Hastings Chronicle, 2014: Key Events 771-1699). A battery for seven guns was constructed overlooking the Stade in 1760; this was also recorded

on an 1833 map and was presumably still armed at that time (Rudling, 2003: 230). Another battery was located on the shore between Bulverhythe and Pebsham. During the Napoleonic era, this battery was replaced by a Martello Tower, one of 74 built along the south east coast in the early 19th century. Although these were generally built 500m apart, there was a small cluster of five at Bulverhythe and a significant gap of seven miles between these and the next one at Pett Level, leaving Hastings itself largely undefended (Saunders, 1989: 142). The five at Bulverhythe (Martello Towers 39, 40, 41, 42 and 43) were all lost in the late 19th century; three were destroyed by the sea and two demolished to make way for the train line. The nearest Victorian defences to be constructed during the 1860 Palmerston Forts construction period were at Newhaven (Rudling, 2003: 191). However, a Victorian volunteer rifle range was established on East Hill, with targets to the east on Ecclesbourne Glen. There may also have been an earlier (Napoleonic era) fortification on East Hill, in the centre of the Iron Age hillfort (Fradley & Newsome, 2008: 15).

Modern

In the 1930s the town enjoyed some renewed expansion. As coastal resorts declined in popularity, the council initiated an extensive rebuilding project. In the 1930s, a long, two tier promenade was constructed between the coast road and the beach and to the west more frequent groynes were built. Inland the town continued to expand to the west, absorbing St Leonards and Bulverhythe (Hastings Chronicle, 2014: Key Events 1900-1949).

The only evidence of purpose built First World War defences in the area is a small group of trenches on East Hill that probably date from this period (Fradley & Newsome, 2008: 21). During the Second World War a number of beach defences were installed to resist an enemy invasion. To the west of the study area a number of road blocks, consisting of anti-tank blocks, pillboxes, minefields and machine gun posts were established at Bulverhythe (Defence of East Sussex Project, 2009: Roadblocks). Little remains of any of these today, although there are eight anti-tank blocks on the beach in front of the railway line. These defended localities continued east along the coast into St Leonards and a number of buildings were fortified to contribute to the overall defence (Defence of East Sussex Project, 2009: Defended Localities). A number of defences were clustered around Hastings Old Town; German reconnaissance photographs show a number of anti-tank blocks and pillboxes around the harbour, although these are not visible today (Defence of Britain, 2006).

Hastings and St Leonards were extensively bombed during the war; a matter that was not helped by the fact that no anti-aircraft guns were installed until late 1940. Some 550 bombs, 760 incendiaries and 16 V1 Flying Bombs fell on the town, killing 154 people and injuring 700 (1066 Online, 2014: World War II). Hastings Pier was 'sectioned' (by removing sections of decking to isolate it from the shore) and occupied by the army. It suffered some damage from bombing raids but reopened in 1946. Various additions were made to it in the 1950s and 1960 and it continued to operate until 2006 when it was closed to the public (National Piers Society – Hastings, 2014). In October 2010, it caught fire in a suspected arson attack, destroying some 95% of its superstructure. Since then, Heritage Lottery Funding has paid for refurbishment of the pier that may see the pier re-open in spring 2015 (BBC, 2014). St Leonards Pier was also sectioned, suffered bomb and fire damage and was not re-opened. After it was severely damaged by a gale in 1951, its remains were subsequently removed (National Piers Society – St Leonards, 2014).

3C.1.3 Archaeological, Palaeoenvironmental and Coastal Heritage Resources Consulted for the Project

A general overview of the prehistoric archaeology of the Sussex area, in particular the geological and coastal change the area has undergone was obtained in *The Archaeology of Sussex to AD2000*. This volume draws on a number of papers to create a thorough explanation of the history and archaeology of the county, which could be combined with records of individual locations within the study area.

Despite its title, *The Archaeology of Sussex to AD2000* really only focusses on history up to and including the Medieval period. Later periods were researched using local websites such as *The Hastings Chronicle* (an online evolution of the print newspaper) and *1066 Online*, an internet guide to Hastings.

A number of records for individual sites and features were identified in the NRHE and accessed through Pastscape. Other sites could be examined through archaeological reports such as *East Hill, Hastings, East Sussex: A Landscape Survey and Investigation* and the *South East Rapid Coastal Zone Assessment Survey*. However, the latter was conducted over some 150 miles of coast and was not therefore suitable for detailed analysis of the study area.

3C.1.4 Art History of the Area

The Sussex coast has a rich history of coastal landscape paintings. Views of the Hastings frontage were included by the great topographers, William Daniell and Richard Ayton, in their *Voyage Round Great Britain* (Daniell & Ayton, 1814), when they passed by in 1824. Daniell produced two fine aquatints of the town looking from both the easterly and westerly directions.

Relatively easy access from London encouraged artists to paint the scenery of the Sussex coast with its dramatic clifflines and the activities of fishermen living and working below from the shore. In the early nineteenth century it is believed that almost every member of the famous Old Watercolour Society visited and painted the scenery at Hastings. Later, the Finden brothers commissioned artists to produce views along this part of the Sussex coast to illustrate their publication *Ports, Harbours and Watering Places of Great Britain* (Finden & Finden, 1838).

During the nineteenth century, Pre-Raphaelite artists, including William Holman Hunt, painted the Sussex cliffs coastline at Fairlight for example '*Fairlight Downs – Sunlight on the Sea*' and his celebrated '*Straying Sheep*', which shows a scene high on the cliffs above Fairlight Cove. Britain's most famous artist, J. M. W. Turner, also chose to visit Hastings to paint a view of the town from sea in July-August 1818.

The London artist, William Collins, painted the coastline here in the 1830s, whilst John Thorpe, a resident of nearby St Leonard's, painted the coast in the 1850s and early 1860s. Another topographic artist, James Francis Danby, visited the town regularly between the 1840s and 1870s. John Mogford, who was well known for his accurate portrayals of coastal scenes, also visited Hastings during the 1840s and 1860s, as did Charles Thorneley, who depicted coastal shipping off many of Britain's famous seaside resorts.

William Henry Borrow, who lived in Hastings from 1876, made an important contribution to the art heritage of the town, producing a series of detailed oil paintings showing the town, the beach and the cliffline from different aspects. In 1901 Charles A. Graves painted '*The remains of the Elizabethan Harbour at Hastings*', which shows the relics of the structure located well down on

the lower foreshore. In the 1920s the prolific watercolourist, Alfred Robert Quinton, painted the beach at Hastings and the cliffs to the east. A further active watercolourist, Ernest William Haslehurst illustrated '*Hastings and Neighbourhood*' (Higgins & Haslehurst, 1920).

3C.1.5 Art Resources Consulted for the Project

Full details of the data sources consulted for the project are available in [Section 2.1](#). In order to establish the art resource available for this study it was necessary to review the topographical paintings, drawings and prints held by the principal national, region and local collections covering the East Sussex coastal frontage. To achieve this objective, on-line reviews were carried out of the collections held at the national level within key museums and art galleries including the Tate Britain, the Victoria and Albert Museum, the National Maritime Museum, the British Museum, the National Gallery and the Witt Library at the Courtauld Institute in London.

In addition it was necessary to establish if there were relevant artworks contained in museums and art galleries in East Sussex including Hastings Museum and Art Gallery, Hastings Library, Hastings Fisherman's Museum and the Royal Pavilion and Brighton Museum collections. As part of the research it was necessary to contact museum and gallery curators and search available publications, as well as undertaking research on the Internet, taking advantage of new facilities such as the Public Catalogue's Foundation volume (Ellis, 2004) and the BBC *Your Paintings* website.

In addition to searches of on-line databases and images held by national and local collections an assessment has been made of art from the study area contained in important publications and, in particular, catalogues of exhibitions at principal London galleries and also in East Sussex itself. The literature sources relating to works exhibited are comprehensive and comprise reviews of the artists and their works (e.g. Graves, 1901), together with catalogues and dictionaries published by the museums themselves and interested publishers (e.g. the Antique Collectors' Club). The published works of this kind do, therefore, represent a considerable resource of assistance to this study (Wood, 1978; Russell, 1969; Archibald, 1980; Lambourne & Hamilton, 1980; Mallalieu, 1984; MacKenzie, 1987).

A small assessment has also been carried out on historic photos, these were obtained through online research. Sources include www.sussexpostcards.info, www.1066online.co.uk and images from the Britain from Above project www.britainfromabove.org.uk. One map was also assessed in order to highlight the potential of this resource, this map was found through an online search of the website Old Sussex Mapped www.envf.port.ac.uk/geo/research/historical/webmap/sussexmap/sussex.html.

3C.2 Current Environmental Impacts, Threats and Coastal Management Approach

This section considers the current environmental impacts and threats along the Hastings coastline and reviews the current coastal management issues and approaches.

3C.2.1 Review of Key Contributors to Coastal Change

This shoreline has been retreating for many centuries, natural processes of rising sea levels and lowering sand levels have been occurring over a long time period meaning that erosion and flooding is nothing new. These natural processes have not been prevented by modern coastal

defence works only delayed. However, many of the natural processes which circulate the sediment from eroding cliffs back into beach building material have been affected by anthropogenic development. Hastings is a popular seaside resort with an important tourism economy, many of these developments are tourism related or residential properties. The dense urban developments at Hastings extend to the edge of the low coastal slope and the town is fronted by a shingle beach. Due to the importance of the tourism economy and fishing industry this coastline is heavily managed, with only small sediment feeds coming from the Pevensey frontage (SMP2, 2006).

The Harbour Arms at Hastings are preventing shingle moving eastwards along the coast, but they also protect the town and support the fishing industry. To the east of Hastings the cliffs are largely undefended, these sandstone cliffs are witnessing continuous weathering and erosion. Erosion along this cliff will mean that sites like the Iron Age Cliff Castle at Hastings will be lost, although new archaeological material may also be exposed as the coastline changes. These cliffs are also of international environmental, geological and ornithological importance, with no significant cliff top development (SMP2, 2006).

3C.2.2 Summary of Current Coastal Management Approach

Hastings is covered within the South Foreland to Beachy Head Shoreline Management Plan (SMP2, 2006). Along this frontage there are two issues to be considered. First, coastal risk management relating to the Hastings resort frontage and, secondly, issues affecting the coastline to the east towards Fairlight. In terms of Hastings itself, there is a substantial value in terms of property, assets and heritage that is protected by existing defences, which have existed as far back as the fourteenth century. Over time, rising sea levels are expected to 'squeeze' the beach, and this may necessitate artificial replenishment in the future. Certainly the intention is to continue to maintain defences, upgrading them where necessary, over the next century.

From the eastern end of the town, eastwards towards Fairlight and Fairlight Cove beyond, the high sandstone cliffs are subject to continuous weathering and erosion. Where there is minimal development along the cliff top, the natural processes of coastal erosion and weathering will be allowed to continue, and certainly the eroding cliffs contribute to the overall sediment budget available along this part of the Sussex coast. However, at Fairlight, there has been significant loss of properties historically as a result of cliff retreat and cliff top instability problems. This has resulted in coast protection works and cliff drainage works being undertaken to reduce the impact of these processes. The intention is to continue to defend those frontages where it is economically justifiable and environmentally acceptable.

The long term policy for Fairlight to Hastings Cliffs will be no active intervention (SMP2, 2006).

3C.3 Archaeological and Palaeoenvironmental Ranking

This section outlines the results of the archaeological and palaeoenvironmental ranking from the Hastings study area, followed by a discussion of the results. The ranking methodology applied is detailed in [Section 2](#).

3C.3.1 Results of the Archaeological and Palaeoenvironmental Ranking

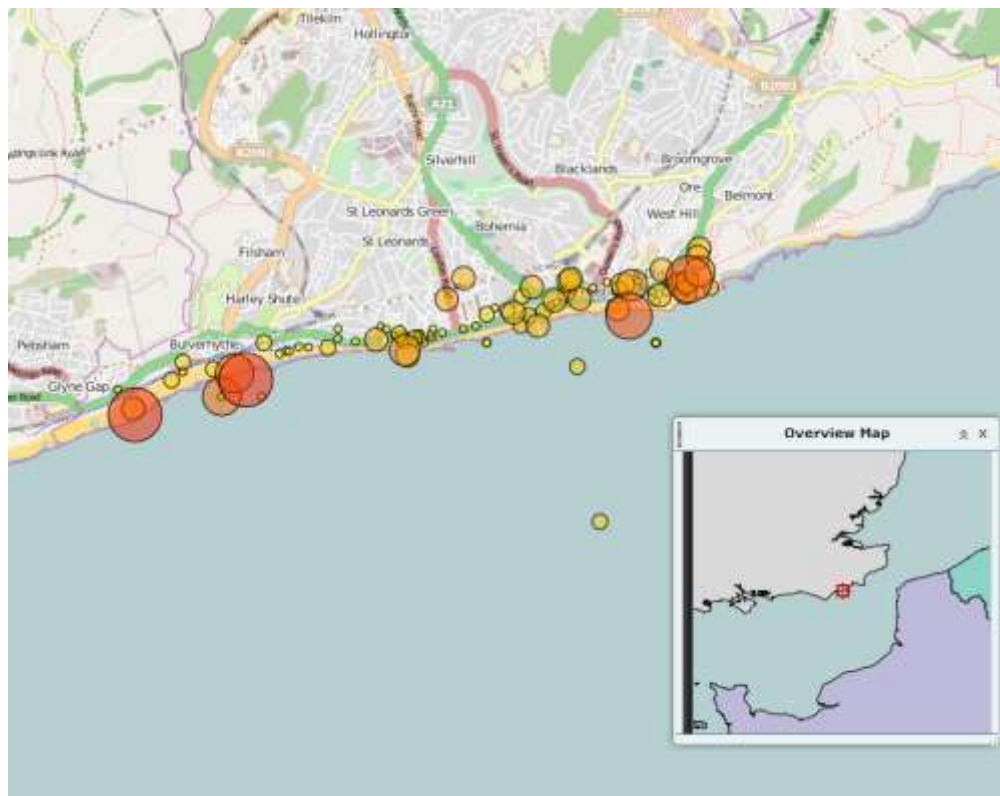


Figure 3C2. Map showing the distribution of archaeological and palaeoenvironmental sites within the Hastings study area

Within the Hastings study area data was obtained from the local Historic Environment Record (HER), the National Record of the Historic Environment (NRHE), the United Kingdom Hydrographic Office (UKHO) and the English Heritage Peat Database. It should be noted that where data from the HER and NRHE indicated sites of potential then further research was required in order to understand the full nature and extent of the site. Each data set went through a process of cleaning, in order to prevent the duplication of sites. A total of 150 sites and records were assessed.

The highest ranking sites are listed in the table below, the total score has been normalised to give each site a score out of 100.

APE uid	Site Name	Site Type	Period	Score – Sea Level	Score – Environmental	Score – Temporal Continuity	Total Score	Coastal Context
708	BULVERHYTHE - Submerged Forest	Submerged landsurface	Prehistoric	High	High	High	100	Marine (below water)
713	LITTLE GALLEY HILL - Submerged Forest	Submerged landsurface	Bronze Age	High	High	High	100	Marine (below water)
2460	HASTINGS - Find Spot	Other find spot	Prehistoric	High	Medium	High	88	Above High Water
711	HASTINGS - Submerged Forest	Submerged landsurface	Unknown	High	High	Medium	88	Marine (below water)
2335	WRECK - Amsterdam	Wreck	Early Modern	High	Medium	Medium	77	Marine (below

								water)
3247	EAST HILL - Iron Age Hillfort	Monument	Iron Age	Medium	Medium	High	77	Above High Water
2368	HASTINGS - Caves	Monument	Prehistoric	Medium	Low	High	66	Above High Water
2464	HASTINGS - Find Spot	Other find spot	Palaeolithic	Medium	Low	High	66	Above High Water
2454	HASTINGS - Mound	Monument	Neolithic	Medium	Low	High	66	Above High Water
2380	BULVERHYTHE - Battery	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2375	HASTINGS - Battery	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2384	HASTINGS - Castle	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2383	HASTINGS - Chapel	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2381	HASTINGS - Church	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2374	HASTINGS - Church	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2382	HASTINGS - Church	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2484	HASTINGS - Church	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2387	HASTINGS - House	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2456	HASTINGS - Kiln	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2394	HASTINGS - Market	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2373	HASTINGS - Mint	Monument	Early Medieval	Medium	Low	Medium	55	Above High Water
2451	HASTINGS - Pier	Marine Installation	Medieval	Medium	Low	Medium	55	Above High Water
2367	HASTINGS - Pier	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2385	HASTINGS - Priory	Monument	Medieval	Medium	Low	Medium	55	Above High Water
2508	HASTINGS - Well	Monument	Unknown	Medium	Medium	Low	55	Above High Water
2482	ST LEONARDS -	Monument	Medieval	Medium	Low	Medium	55	Above

	Church							High Water
2498	ST LEONARDS - Church	Monument	Early Modern	Medium	Low	Medium	55	Above High Water
2450	ST LEONARDS - Hoard	Other find spot	Bronze Age	Medium	Low	Medium	55	Above High Water
2389	ST LEONARDS - Pier	Monument	Early Modern	Medium	Low	Medium	55	Above High Water

Table 3C1. Results showing the highest ranking archaeological and palaeoenvironmental sites within the Hastings study area

3C.3.2 Discussion of the Ranking Results

The coastline of the study area, and that of East and West Sussex, has seen considerable change both during and since prehistory and the full extent of this is well demonstrated by a Bronze Age drowned landscape off Hastings. The most dominant features in the archaeological ranking are the submerged forests offshore of the study area. These examples of forests almost certainly made up one large prehistoric forest that stretched across this area of Sussex. This forest would have developed from the rich peat that had formed in this area and grown to its peak in the early to middle Bronze Age (Rudling, 2003: 6). It is also the flooding of the peat beds east of the study area that gives us a rough time frame for the advancement of the sea to this level (Rudling, 2003: 8). It is difficult to fully identify the prehistoric coast off East Sussex and its exact location and shift north over time is largely postulated (Rudling, 2003: 2). The Bronze Age forest is therefore the only hard evidence of a changing coastline, and certainly suggests a northward shift over time.

Above the mean high water mark, a number of other prehistoric sites might also suggest coastal change. Although further inland, the probable hillforts on East Hill and West Hill would have had commanding views of the coast, and may represent the promontory hillforts that are often seen in coastal locations (Fradley & Newsome, 2008: 25).

The concentration of medieval and post medieval sites along the present day shoreline of Hastings, although lower ranking, still tell us much about the stabilisation of the coastline in the study area in this period. The continued use of the fort on West Hill in both the Saxon and Norman periods and the establishment of settlements in the Bourne and Priory Valleys suggests settlement just inshore of the waterfront, making use of the lower ground protected from the elements by the hills (and by the fortifications on them).

A high ranking site that tends to support this is the wreck of the Dutch East India vessel *Amsterdam*. Wrecked in 1749, the stability of the wreck in the sandy mud of the foreshore has kept it well preserved (this stability continued after it was first photographed in 1911 until 1969 when it was first surveyed). This may suggest a stabilisation of the waterfront, doubtless aided by human activity, particularly the number of groynes built here and to the west at Bexhill. That said, exposed areas of the ship are slowly being destroyed by Toredoshipworm.

A result of this apparent coastal stabilisation is that more modern features tend to rank lower. A number of early modern and 20th century features rank quite lowly, owing to their recent construction and stable positions on land. On the other hand, the two piers have a slightly higher rank, reflecting the weathering they have suffered as extreme weather threatens the shore.

3C.4 Ranking Artistic Depictions

The focus on artistic depictions of the Hastings study area has been on historic paintings, however several historic photographs, maps and charts were also assessed in order to highlight the potential of this resource. The results of the ranking for each of these is presented below followed by a discussion.

3C.4.1 Art Ranking Results

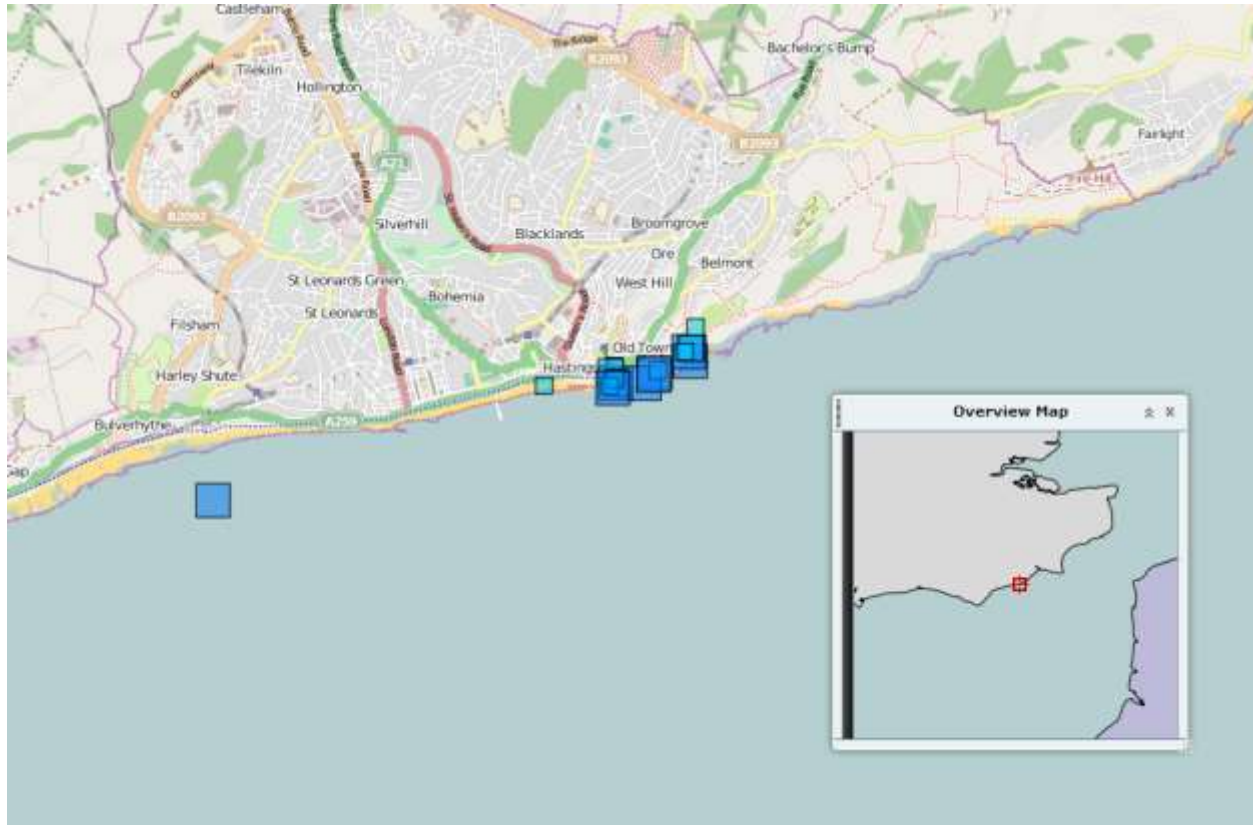


Figure 3C3. Location of artistic depictions ranked

The highest scoring artwork, a watercolour by A.R. Quinton, gained 70 points whilst two coastal engravings (a lithograph and a woodcut) each scored 59 points. Six oil paintings from the mid to late nineteenth century scored 59 points and have been the subject of more detailed study. The information imparted by these artworks is described in the case study below. The case study images depict the main beach fronting the resort and also show the sandstone cliffs and beach at the eastern end of the frontage. Further details on the ranked artworks are provided in Table 3C2 below.

Artists tended to paint attractive or dramatic coastal locations as well as meeting specific demands of their patrons. On the Hastings coast they were drawn to both the expanding and fashionable coastal resort and the activities of fishermen working along the shoreline from below the cliffs at the eastern end of the seafront. In many of the Hastings paintings, watercolours and prints the beach and cliffs are portrayed particularly well.

The result has been that many of the sites of key geomorphological and coastal risk management interest have been painted by artists particularly during the nineteenth century. As

the aspiration of Activity Two was to illustrate how art can inform us of long-term coastal change it is fortunate that within the higher scoring artworks there are examples, which include locations affected by coastal and beach change.

These differing coastal landforms and processes and their impacts on coastal residents, assets and infrastructure could not have been easily matched to the most informative works of art without the provision of the ranking system. The ranking system has identified two case study locations along the Hastings beach frontage and, for each, several works are analysed as follows:

Case Study Number	Location	Artist	Date	Score type	Score period	Score style	Score enviro	Total Score
3.1	Hastings Main Beach	William George Moss	1814	Oil	Early	Topog.	Detailed View	48
3.2	Hastings Main Beach	William Henry Borrow	1879	Oil	Mid	Topog.	Very Detailed View	59
3.3	Hastings Main Beach	William Henry Borrow	1885	Oil	late	Topog.	Very Detailed View	59
3.4	Hastings Main Beach	Edwin Hayes	1885	Oil	late	Topog.	Detailed View	59
3.5	Hastings Beach & Old Harbour	Charles A. Graves	1901	Oil	Late	Topog.	Very Detailed View	59
3.6	Hastings Beach	English School	c.1880	Wood cut	Late	Topog.	Detailed View	62
3.7	Fish Market Hastings	Alfred Robert Quinton	c.1920	Water colour	Late	Topog.	Detailed View	70
3.8	East Cliff & Fishing Village	English School	c.1850	Lithograph	Mid	Topog.	Detailed View	59
3.9	Hastings from East Cliff	William Henry Borrow	1881	Oil	Late	Topog.	Very Detailed View	59

Table 3C2. Top art ranking results for the Hastings case study

A more detailed interpretation of the individual artworks is provided in the case study description below. The assigning of scores to each artwork suggests names of those artists who have depicted different aspects of the Hastings Study Site coast most accurately across the timeline 1770-1920. These artists include William Henry Borrow, Edwin Hayes and Alfred Robert Quinton; they can be relied upon in terms of the accuracy of their depictions of the East Sussex coastline.

3C.4.2 Historic Photographs Ranking Results



Figure 3C4. Location of historic photos assessed within the Hastings study area

The focus of the Hastings case study area is on the archaeological/palaeoenvironmental data and historic paintings. However, in order to demonstrate the potential of historic photos a selection of six images were assessed, the results of the ranking are presented below, the ranking methodology is outlined in [Section 2.2](#). Hundreds of historic images exist for this stretch of coastline, it should be noted that this study is not intended to be exhaustive, it simply aims to highlight the potential for historic photos to provide information on coastal change. A brief search of resources available online was carried out, although further research online, in museums and galleries, as well as private collections has the potential to provide many more.

The table below outlines the results of the ranking, note that photographs were ranked as either a heritage view or a non-heritage view.

Img_uid	Title	Year	Score Heritage View	Score Non Heritage View	Physical Image State	Total Score
1190	S.S. <i>Lugano</i> on fire off Hastings harbour arm	1906		High	Fair	88
1191	Hastings Harbour	1918		High	Good	100
1192	West Marina and Station	1920		High	Good	100
1193	Willowpit Wood Hastings Country Park from the west	1920	High		Good	100
1194	Rock a Nore Road and East Hill Cliffs	1946		High	Good	100
1195	The pier and town centre Hastings	1920		High	Good	100

Table 3C3. Results of the photo ranking within the Hastings case study area

The majority of photos assessed were of heritage views, containing features which can be identified today, the oldest photo assessed was taken in 1906.

3C.4.3 Maps and Charts Ranking Results

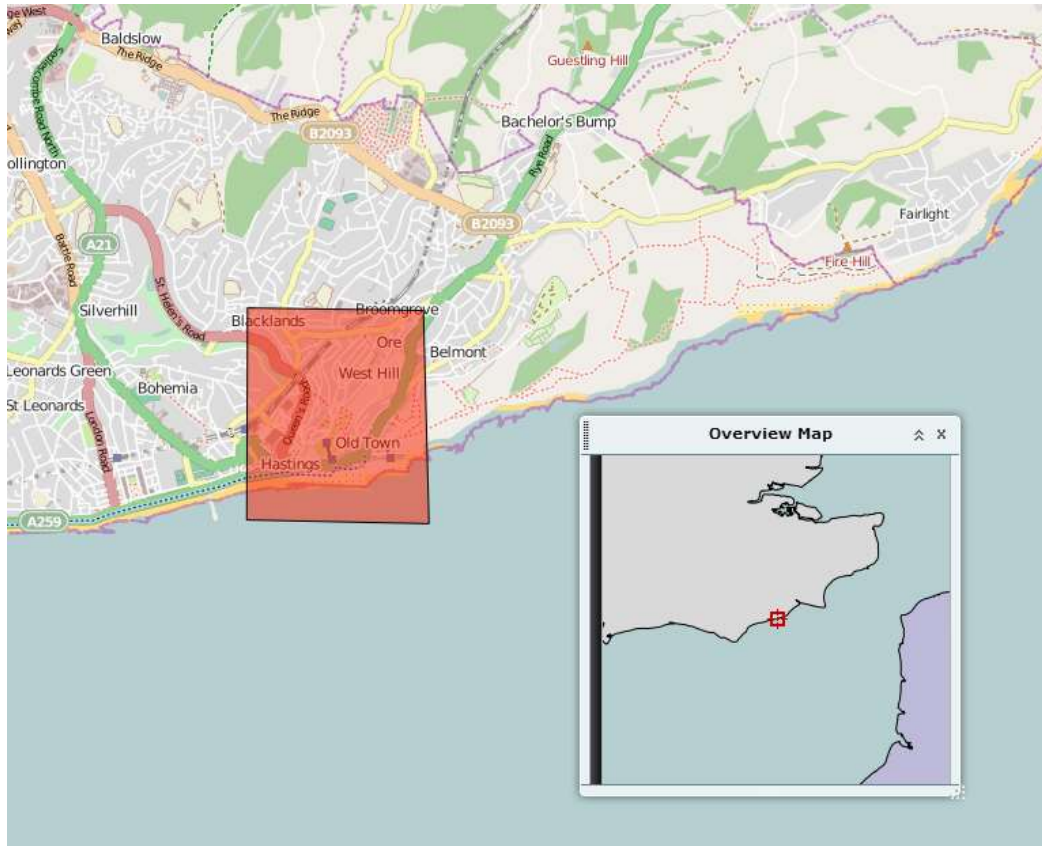


Figure 3C5. Location of the historic map ranked within the Hastings case study area

The focus of the Hastings case study area is on the archaeological/palaeoenvironmental data and historic paintings. However, in order to demonstrate the potential of historic maps a plan of Hastings and St Leonards from 1890 was assessed, the results of the ranking are presented below.

MAP_uid	Title	Year	Score Chronometric Accuracy	Score Topographic Accuracy	Score Detail in non-coastal area	Score Geometrical Accuracy	Total Map Score
144	A Plan of Hastings & St Leonards	1890	93.33	50	100	100	85.83

Table 3C4. Results of the map ranking within the Hastings case study area

3C.4.4 Discussion of the Ranking Results

The Hastings case study has assessed the value of various artworks in terms of informing us about beach change and cliff conditions through a combined approach of desk-based research, museum and gallery searches and field visits. These have confirmed the added value of art from the period 1770-1920 to support other coastal surveying and monitoring technologies (e.g. space-borne, air-borne, ship-borne and terrestrial). It is important to remember that artists in the late Georgian and Victorian eras worked for very demanding, wealthy clients who often sought exact views of the coastal landscape to remind them of their visit. Before the days of

photography precise images were, therefore, a prerequisite in most cases. The examination of the works of many artists painting the Hastings coast testifies to their considerable artistic skills in capturing accurately the coastal topography.

The artworks examined illustrate the form of Hastings beach over time. Some of the paintings show little change over the last two hundred years and this information is of equal interest to the coastal scientist.

The Hastings study focused on the use of historic paintings, however historic photos and a map were also consulted to review the potential of these data sources. Because of the dynamic nature of this coastline historic photographs can be a valuable resource with many historic photos containing depictions of the cliff with recognisable heritage features nearby. Five of the six historic photos showed heritage features, these include West Marina and Station, Hastings Pier, Hasting harbour and the Fairlight coastguard station. These can be compared to the modern situation and from this an idea of the rate of erosion since the date of the photograph can be gained.

Only one map was assessed in the scope of the project, this highlights the potential of historic maps to provide detailed information on coastal change. The map selected is from 1890 and scored highly. The high score means that the map is accurate and can be used to determine changes since 1890. Although the map scored highly overall the lowest score was for topographic accuracy which refers to the types of depicted elements. In this case the division between cliffs and beaches and the division between the coastal, intertidal and subtidal areas, was only scored as 'depicted' as opposed to 'well depicted' (see [Section 2.2](#) for the ranking methodology). The geometric accuracy was high, this is mainly due to the detail of structures like churches, roads and other buildings which allowed for several accurate control points, this level of detail is also reflected in the maps high score for detail in non-coastal areas. The map also scored well for chronometric accuracy, the date of the map is known and terrain measurements are noted on the map.

3C.5 Art Field and Research Studies

No archaeological or palaeoenvironmental fieldwork was carried out for the Hastings case study site, this section, therefore, outlines the field studies undertaken as part of the art study.

3C.5.1 Key Research Questions to be Addressed from the Artistic Depictions

It has been possible to establish, through the art ranking system that the images are likely to be true representations of the conditions that would be seen at the time they were painted; the research questions to be answered through examination of the artworks at the Hastings case study sites are:

- What information can the historical images provide to support understanding of long-term coastal change?
- How can the potential of this resource be used most effectively by the end-user?

In order to identify the most suitable artworks that could be studied in more detail at the field study sites a national search was undertaken involving an extensive review of landscape paintings, watercolours and prints held in public and some private collections. Following ranking of 24 artworks twelve examples have been the subject of more detailed analysis involving site visits.

Along the Hastings frontage there are a range of physical conditions to be found that are of concern for coastal managers including eroding cliffs and cliff instability problems to the east of the town, and the potential for beach change. In order to reflect these varying conditions art images have been selected which examine the state of the main resort beach in front of the town and also the cliffs and beach at the eastern end of the frontage where the historic fishing village is situated.

3C.5.2 Approach to Information Gathering and Fieldwork for Assessing Coastal Artworks

Where it has been practical to gain access and relevant to the study, present day photographs were taken in the field to try, as far as possible, to match the views painted by the eighteenth, nineteenth and early twentieth century artists. It also provided the opportunity to assess the conditions of the cliffline and beach and changes that may have taken place over time. In terms of work in this field each of the locations has been visited and photographed in varying weather conditions. Inspections were timed to coincide with Low Water and a walk-over survey was made along the beach and base of the cliff returning along the cliff top. This ensured that thorough comparison could be made between the geomorphological conditions depicted in the artwork and the present day situation.

3C.5.3 Art Field Data Gathering Results

The Hastings case study was chosen to reflect two geomorphological processes, namely beach conditions along a developed frontage, and unstable coastal cliffs. Site inspections have confirmed that the locations selected do provide a good representation of these coastal geomorphology types against which the value of historical artworks can be tested.

The fieldwork element for Activity Two has been largely visual in terms of identifying the location of the paintings and making judgements, on site, of the role that art can fulfil as a qualitative or quantitative tool to support coastal risk management. The field inspections allowed a more accurate appraisal to be made of current physical conditions rather than relying upon written accounts and reports particularly as storm events can cause significant alterations over relatively short time periods.

The approach adopted for the case study has been the examination of each artwork to assess what it tells us about changes over time from field observation. At Hastings several artists painted the view from the same or a similar spot. This helps us to establish a chronology of coastal change through the nineteenth and twentieth centuries. The results for the Hastings case study are described below.

C1 Hastings Beach and Cliffs

Location

The case study site extends for a distance of approximately 2km along the Hastings resort frontage and east past the fishing village.

Why was the study site selected?

This site was selected in order to demonstrate how art reflects beach conditions over time. Hastings beach and the activities of the fishermen on the shore were a magnet for Victorian and Edwardian artists, and as a result there are numerous views of this location. The case study

also includes views of the cliffs behind the fishing quarter at the eastern end of the frontage and reviews the depiction of the unstable sandstone cliffs.



Figure 3C6. 'Rescue at Hastings' by William George Moss, 1814. This oil painting shows the Hastings frontage from Low Water Mark, looking east along the extensive beach towards the town, and the high sandstone cliffline beyond. Image courtesy of Hastings Museum & Art Gallery.



Figure 3C7. An oil by the prolific Hastings artist, William Henry Burrow, dated 1885. The relatively gentle sloping foreshore can be observed. Hastings Castle on the top of the cliffs overlooking the expanding seaside resort. Image courtesy of Hastings Museum and Art Gallery



Figure 3C8. A further oil by W. H. Borrow, dated 1879, showing the steeper beach at the eastern end of the Hastings frontage; this is also reflected in the present day view. Image courtesy of Hastings Museum and Art Gallery



Figure 3C9. An oil by Edwin Hayes entitled 'Old Hastings', 1880, taken from Low Water Mark, showing the considerable expanse of beach at that time. Image courtesy of Hastings Museum and Art Gallery



Figure 3C10. 'Remains of the Elizabethan Harbour at Hastings' by Charles A. Graves, 1901. This view shows the timber relics of the harbour. Beyond is the fishing village and behind it the jointing and mechanisms of failure of the rugged sandstone cliffs are particularly well painted, Image courtesy Hastings Museum and Art Gallery

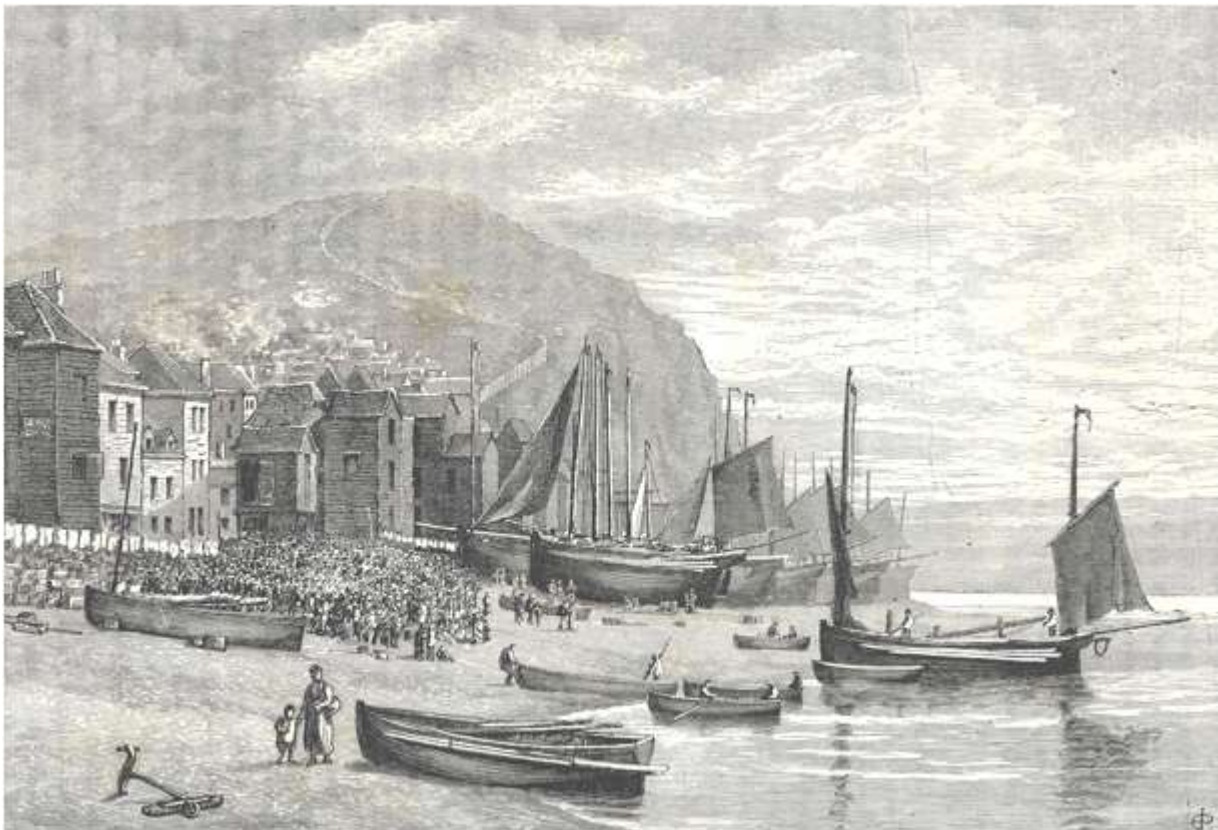


Figure 3C11. A woodcut, circa 1880, showing the beach and fishing village. The timber sheds belonging to the fishermen can be seen on the beach. Private Collection



Figure 3C12. A detailed watercolour of the eastern end of Hastings beach in about 1920 by Alfred Robert Quinton. The boats are beached at the waterline below a change in the profile of the shore, which is still present today. The castle is visible on the cliffs behind. Image Courtesy J.Salmon Ltd



Figure 3C13. This lithograph, published in about 1850, looks westwards from below the cliffs and shows the fishing village and town beyond. The cliffs in the foreground are well-jointed and crumbling; the beach looks extensive at this time. Private Collection



Figure 3C14. A panoramic view by W. H. Borrow from the top of the cliffs looking westwards in 1881. The geology is carefully painted and shows the dipping, jointed strata. The scene is painted at High Water as the sea abuts the promenade. Image courtesy of Hastings Museum & Art Gallery

Geomorphological setting

As well as considering the impact of erosion and historical sea level rise on Hastings amenity beach the study area included a weak sandstone cliffline at the eastern end of the town (see Figure 3C14). The cliffs are composed of sandstones, which are susceptible to the processes of weathering, and erosion at their toe by the sea along the undefended sections. The jointing in the cliffs means that sections are prone to breaking away in massive blocks and causing toppling failures. Once the material falls onto the beach, it is quickly removed by the sea, enabling the cycle of events to initiate once again. Ground water, soaking through the permeable cliffline and emerging at different points through the cliff face, is also an important process which speeds up the instability problems.

Where the main Hastings frontage is defended, rising sea levels and a possible increase in more unsettled weather patterns could lead to increasing beach drawn-down, changing its morphology in future years. This is likely to necessitate further coast protection measures in order to maintain the beach in the future.

Key coastal risk management issues for the frontage

The sandstone cliffs will be allowed to continue to weather and erode except where there is economic justification for protection of property and assets. Along the Hastings town frontage, the value of assets currently being protected by the existing seawall and beach is substantial. The policy is to continue to maintain and upgrade defences where necessary, looking ahead for the next 100 years.

Observations on the artwork

Nine views have been selected to illustrate different aspects of coastal change along this frontage. These relate particularly to beach conditions but three views also illustrate the nature of the cliffline and the wider geomorphological setting. Finally, an interesting painting by Charles

A. Graves, dated 1901, (figure 3C.10) shows the remains of the Elizabethan harbour projecting from amongst the rocks on the lower foreshore. Artworks containing information on historical structures such as this can help build up a picture of the changing coast over the centuries and, with other archaeological data can support our understanding of past coastal developments.

A lithograph by an artist of the English School, c.1850 (see Figure 3C.13) shows the fishing village located at the eastern end of the main beach. The view is interesting in that it shows the extent of the beach at the time, and also the cliffline displaying the well-jointed sandstone. Figures 3C.7 and 3C.8 provide views taken from the lower beach, looking eastwards along the frontage. They were painted by the prolific local artist William Henry Borrow in 1885 and 1879 respectively. They show the extensive beach at the time and also the steepening of the beach in the intertidal zone; a feature that exists at the eastern end of the beach today.

Figure 3.14, a further oil by Borrow, is taken from the cliff to the east of Hastings and looks westwards along the coastal frontage, with Hastings Pier in the middle distance. This view is taken at high water, and it shows the sea touching the promenade. In the foreground the cliffs are well depicted, showing the jointing and bedding planes. The weathered surface on the top of the cliff, partly vegetated, can also be seen.

How can the artworks inform coastal risk management?

The lithograph of the eastern end of Hastings beach (Figure 3.13) is relevant in this respect because it shows the extent of the beach in the mid-nineteenth century. It has been increasingly recognised that it is necessary to take a long-term perspective when looking at coastal issues and to understand the processes of coastal evolution over time. By making decisions about coastal risk management policy, looking ahead for the next 100 years, it is important to understand the rate and scale of change over time, and images of this kind can help explain beach conditions in the past.

The collection of views by Borrow of Hastings beach will be of interest to coastal engineers wishing to understand how the frontage may have changed over time. This and other works held in the Hastings museum illustrate the form of the beach over a 150 year period. It has been explained that the beach may become under increasing pressure as a result of rising sea levels and ‘squeeze’ over the next 20-50 years, and an examination of such historical images can allow the changes to the beach over time to be plotted and better understood.

The painting by Graves of the Elizabethan harbour (Figure 3C.10) is included in this case study because it provides a link with the work of Activity One of the Arch Manche project. It is one of many examples of coastal landscape paintings, which include archaeological and maritime heritage evidence. Such images can provide evidence alongside archaeological fieldwork to help understand past coastal developments and activities around the English coast.

Where can the original artworks be viewed?

There is a large collection of paintings of the Hastings area contained in the Hastings Museum including twenty-five oils by Borrow. They can also be viewed on the BBC Your Paintings website (www.bbc.co.uk/yourpaintings).

Ranking score achieved

The scores range from 48 -70 (see Table 3C2).

3C.6 Analysis

The Hastings study area has combined the use of archaeological and palaeoenvironmental data, paintings, historic photographs, maps and charts in order to demonstrate how these tools can be used to improve our understanding of coastal change in the long and short term. A particular focus has been on the area around the Harbour Arm and the impacts of this structure on the sediment regime as well as erosion to the cliffs further east. This section reveals the most informative and reliable data gathered from this study area for contributing to understanding of the scale and pace of coastal change.

3C.6.1 Archaeological and Heritage Features

The archaeological and palaeoenvironmental data from the Hastings case study area can provide detailed information on the changing coastline from prehistory to more recent times. In particular, high ranking sites such as the dated submerged forest off Little Galley Hill provide key information on changes in sea level and the environment since the Bronze Age. Nearby the submerged forest at Bulverhythe is now exposed at low tide although the exact dates are unclear. These sites are now 150-230m from the current high water mark. The site of Little Galley Hill contains remains of an oak and hazel forest and the site of Bulverhythe contains deer antler which is thought to have been worked as well as 13th Century pottery in the upper peaty layers. Further east the submerged forest just south of Pelham place contains leaves, hazel nuts, acorns, oak and deer antlers.



Figure 3C15. Aerial photo of Hastings showing the high ranking submerged forests of Little Galley Hill and Bulverhythe within the Hastings study area

Further work is required to understand the full nature and extent of these sites, but all have the potential to provide key data on changing sea levels and environment and with further analysis could be used to create evolution models of the changing coast from at least the Bronze Age.

Although the submerged forests scored highest, there are many other sites in the Hastings area which can still provide information on the changing coast. The concentration of medieval and post medieval sites along the present day shoreline of Hastings, although lower scoring, still tell us much about the stabilisation of the coastline in the study area in this period. The continued use of the fort on West Hill in both the Saxon and Norman periods and the establishment of settlements in the Bourne and Priory Valleys suggests settlement just inshore of the waterfront, making use of the lower ground protected from the elements by the hills (and by the fortifications on them).

A high scoring site providing data on changing coast conditions since 1749 is the wreck of the Dutch East India Company vessel the *Amsterdam*. Wrecked in 1749, the stability of the wreck in the sandy mud of the foreshore has kept it well preserved (this stability continued after it was first photographed in 1911 until 1969 when it was first surveyed). This may suggest a stabilisation of the waterfront, doubtless aided by human activity, particularly the number of groynes built here and to the west at Bexhill. That said, exposed parts of the ship are slowly being destroyed by Toredos shipworm.

3C.6.2 Artistic Depictions

The Hastings study site has provided a collection of artworks, which illustrate the performance of the beach over the last 150 years. It shows that although there have been some changes in beach profile, overall these have been slight and compare favourably with present day conditions. The study shows how coastal conditions can be monitored over an extended period if there is a sufficient resource of reliable artworks available for study.

Certain topographical artists such as W. H. Borrow were interested in providing a true record of coastal conditions without feeling the need to resort to changing the view to make it more 'pretty'. His views of the beach, and the cliffs to the east, which are subject to continued failure, demonstrate the processes of physical change on this coast since the 1850s.

The Hastings site, together with the Isle of Wight, represent two locations around the Channel coast on the English side where almost all the leading artists through the Arch-Manche art study period (1770-1920) visited and painted. Their artworks, therefore, provide a unique chronological succession of images that are available for analysis by coastal scientists, engineers, planning officers and other stakeholders.

The Hastings site was chosen for three reasons. First, because of the rich resource of artworks. Second, because of the concern to maintain the main beach, which is a vital tourism asset, and, finally because artworks also depict the nature of the unstable sandstone cliffs at the eastern end of the frontage.

In terms of illustrations of the beach, by Victorian artists in particular, there are numerous examples including many detailed works held by Hastings Museum and Art Gallery. Certain topographical artists such as William Henry Borrow were interested in providing a true record of coastal conditions without feeling the need to change the view in any way; his works exhibit a Pre-Raphaelite eye for detail. The views by Edwin Hayes (Figure 3C9) and by Charles Graves (Figure 3C10) show a flat lower shore with the beach rising more steeply to the east. The step in

beach levels is indicated in the watercolour of the fishing fleet by Alfred Robert Quinton (Figure 3C122)



Figure 3C16. A view from Hastings Beach, comparison of the high ranking 1920's painting (Courtesy J.Salmon Ltd) with a current photo (copyright N Chadwiick). Raised beach levels can be seen

As a result it has been possible to examine the form of the beach from both the east and the west as well as from Low Water Mark. The images suggest that there have been fluctuations over the last 150 years, including a marked change in profile towards the eastern end of the beach below the fishing village. However, over time there does not appear to have been significant beach loss or gain.

It is important for those involved in coastal risk management to understand whether beach levels have been maintained at broadly the same levels over a long period of time or whether there is a trend towards beach lowering. With rising sea levels there are concerns about coastal squeeze and reduction of beach levels against the hard defences (the sea wall) at the top of the beach; this may require beach replenishment to maintain the required standard of protection over time. The historical evidence appears to show little change, over the last century in particular.

A further area of concern to coastal managers is cliff erosion and instability and this has proved to be a problem extending eastwards from Hastings towards Fairlight village. Several paintings and prints show the weak cliffs and the nature of the jointing and failure mechanisms. Studies of coastal instability elsewhere (eg: on the Isle of Wight and Dorset coasts), have recognised that an understanding of the history of landslide and cliff failure processes and mechanisms is fundamental to development of successful risk management strategies and planning policies.

Images of coastal cliffs such as those by W.H Borrow of Hastings to Fairlight (eg: Figure 3C.14) can contribute very usefully to this understanding by showing the state of the cliffs over time.

Historic photographs and maps/charts have also provided key information on coastal change. Figure 3C177 shows a 1920 image of the Hastings coast looking east towards the Fairlight coastguard station and a modern day aerial photo of the same area. Although it isn't possible to take exact measurements it does show that the cliff south of the coastguard station has retreated, the erosion of these soft cliffs is also noted in the Shoreline Management Plan (SMP).



Figure 3C17. The image on the left shows the view eastwards from Willowpit Wood, the Fairlight coastguard station can be seen in the distance (red star), the modern image on the right shows the current position of the coastguard station in the background, and the approximate position of the photographer above Willowpit Wood in the foreground (red stars). (Historic image © English Heritage)

Although it was only possible to look at a few historic photographs and maps in the scope of the project, a brief review of the Ordnance Survey County Series maps show the changes along Hastings waterfront between 1875 and 1938 (Figure 3C18). This covers the period in which the Stade beach harbour was built and abandoned and Hastings and St Leonards piers were built.

The first map of the series; the First Edition, completed in Hastings in 1875, shows the completed Hastings Pier, but construction of neither the harbour or St Leonards Pier have begun. The Stade beach is marked, as are a number of the fishermen's net huts. The mean high water mark is shown as running just below the Parade road along most of the waterfront and is clearly affected by the large number of groynes built in this area, resulting in an

inconsistent height of high water between each groyne. At the Stade, the beach is presumably steeper as the high water mark is only half way up it and does not reach the huts. A large number of rocks, exposed at low tide, are shown in the vicinity of the Tudor harbour wall construction sites. These are labelled 'Pier Rocks' in the second edition map.

The second edition (or first revision) map of 1899 is of a markedly different design to the first. By this point, St Leonards Pier has been constructed and Hastings Pier has been expanded. The harbour breakwaters on the west and east sides of the Stade have been constructed, which has had a marked effect on the Stade beach itself. The beach has projected further out to sea pushing both the low and high water marks several meters to the south. Where previously the Stade was slightly inland as the shoreline followed the curve of the coast, the Stade beach is now level with the waterfront to the west in front of Hastings. This has also had a small impact to the west of the harbour in the area around the Pier Rocks. Previously these rocks marked the curve of the shoreline following the coast to the northeast; now longshore drift has built the beach right up to the new breakwater and the waterline continues almost due east despite the north east curve of the coast.

The third edition (or second revision) was completed in 1909 and shows a dramatic change within the harbour. To the west side, sediment has built up against the breakwater, moving the mean low water mark some 140 metres to the south. On the east side, the increase in sediment has not been so marked, so the waterfront within the harbour breakwaters now runs to the north east. At the same time, the mean high water mark has also moved several metres north on the east side of the Stade, suggesting that the beach slope has been much reduced. Outside the breakwaters, there has been no noticeable impact on the shore around Pier Rocks.

Some of these changes are visible in a number of historic photographs from the early 20th century. A photo of the steamship *SS Lugano* on fire just outside of the harbour breakwater was taken on the 27th April 1908. The tide is clearly in, possibly at the mean high tide level. The breakwater is shown to consist of a stone built outer arm running north-south, with a curved arm at the southern end that turns to the south east. This stone arm is connected to the shore by a wooden pier through which the water is clearly able to run at high tide. It might be considered surprising therefore, that such an extent of sediment has been able to build up on the harbour side of the breakwater; feasibly this should be eroded by the water from the west side of the breakwater even at low tide. In fact, a photograph of circa 1918 taken at low tide tends to support this; although the exposed beach within the harbour is significantly further south than the east side of the Stade or the beach west of the harbour, it is waterlogged and predominantly a level surface with a few raised sandbars.

The fourth edition (or third revision) map of 1938 shows several significant changes to the breakwater. The wooden pier is now buried by the beach, the mean high water mark to the west has been pushed some 80m out to sea and the mean low water mark is now 50m further out. Inside the harbour the mean high water mark has also been pushed a similar distance southwards, although the mean low water mark has remained where it is. However, it is obvious that construction on the roadside above the high water mark has had some impact. The construction of a boating lake and fish market just inshore of the western harbour wall has clearly involved some construction to shore up the coast; previously the high water mark ran through the boating lake and almost up to the door of the market. It is possible therefore, that the increased sediment deposition all around the harbour wall was deliberate.

Modern aerial imagery can be used to see the changes that have taken place since the 1930s. The most significant change has been the mean low water mark, which has again moved further

out to sea. It is now some 120m further south and is only some 40m from the southern tip of the breakwater. The breakwater itself has been broken at several points, so water can flow through the curved southern section at all points of the tide; this may be the reason that the low water marks on both sides of the breakwater are now similar. However, the mean high water mark has again moved down the beach on the west side of the breakwater, now by approximately 90m. It is possible that this is deliberate shoring of the beach to allow fishing vessels to be parked on the beach in front of the market/boating lake area, but equally it is likely that eastward moving longshore drift has deposited increased quantities of sand against the breakwater.

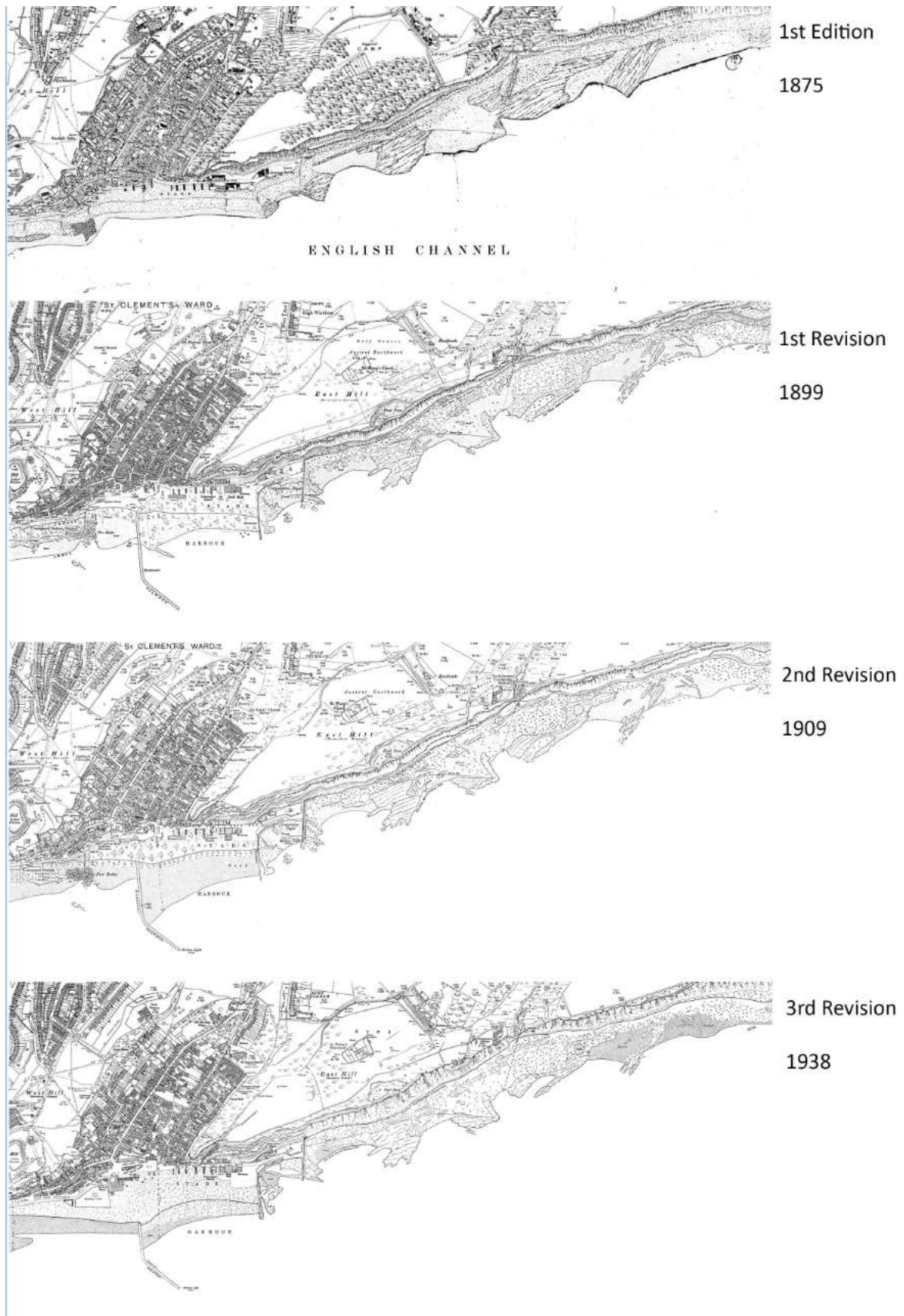


Figure 3C18. Historic OS Maps from 1875-1938. Images Courtesy Landmark Information Group Ltd

3C.6.3 Combined Resources

As demonstrated above, Hastings contains a wealth of information which can improve our understanding of coastal change, ranging from prehistoric archaeology to 19th Century paintings and 20th Century maps. Combining this broad range of data it is possible to understand coastal change in both the long and short term. Several areas along the Hastings coastline contain all types of data; archaeology, art, photographs and historic maps.

One example of this is the harbour wall. In the late 19th century the harbour Commissioner began construction of a harbour, however, due to the nature of the seabed and the inadequate financing work was stopped. The harbour arm is the remains of this construction attempt and has protected the beach and town for both tourism and fishing. As mentioned above the current SMP proposes that the arm is maintained in order to continue this protection. Historic photos and maps can help us to understand the sediment regime and the impact of the arm on the coastal processes along this frontage. In Figure 3C19 you can clearly see how sand has built up against the arm since the photo was taken in 1918, the timber section is now completely covered by sand and shingle.



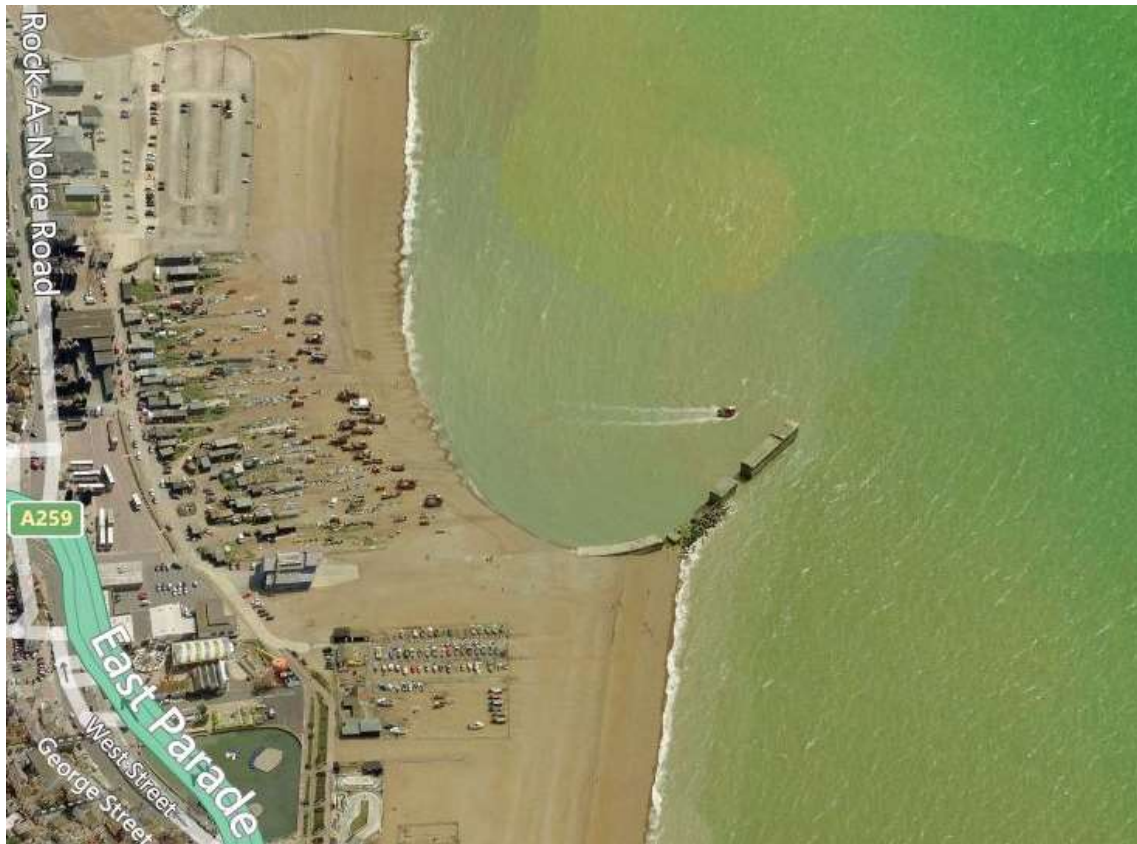


Figure 3C19 (A&B). The top photo (A) shows Hastings Harbour Arm in 1918, below (B) is a present day aerial image.

This area is also depicted in a map from 1890 prior to the building of the harbour arm, compared to a modern aerial image it is clear to see how the sediment has built up and provided a larger beach in the area around the harbour arm.



Figure 3C20. Plan of Hasting and St Leonards (left) Bacon 1890. Aerial photo of the same area, the yellow box marks the area covered by the 1890 plan (right).

This change over time can also be seen clearly in the historic OS maps discussed above (Figure 3C18).



Figure 3C21. 1st Edition OS Map overlaid on 2013 photography. The red arrow depicts the changing high water mark

The addition of the humanly constructed feature – the Harbour arm has clearly impacted the coast with increasing sediment levels and creating a shoreline which is artificially seaward of its natural position.

3C.7 Conclusions and Recommendations

- The Hastings art case study site appears to show no significant change to the beach over a very long period of time, however, historic maps and photos clearly show the changing sediment levels around the harbour arm to the east of the study area. Artworks of the Hastings coast should be used to support understanding of changing beach conditions over time. The fact that changes appear to have been modest over the last 150 years should be noted in the context of predicted changes for the next century.
- This part of the East Sussex coast was painted by numerous artists and this provides a chronological succession of works available for study. The paintings by William Henry Borrow, in particular, demonstrate the level of artistic detail that could be achieved by some nineteenth century artists. This can then be combined with historic maps and photographs to provide a detailed picture of change over the last 2-300 years.
- In order to understand changes even further back the Hastings case study area contains several examples of submerged prehistoric forests. Further work is required to date the sites more precisely and to carry out environmental analysis, this would then allow for an

evolution model of the changing coast to be created from at least the Bronze Age to recent times when combined with the artistic depictions.

- More recent archaeological sites can also provide detailed information, in particular on sites where there is a programme of monitoring such as the wreck of the *Amsterdam*, these sites can provide information on changing sediment levels, and in the case of Hastings this area of the beach appears to be relatively stable.
- Monitoring of beach levels and erosion has been ongoing for the last 10-20 years. Archaeological and palaeoenvironmental data, historic paintings, maps, charts and photographs can extend this back hundreds and even thousands of years. The data can not only provide quantitative information on coastline position, but can also provide qualitative information that can assist in illustrating coastal changes to a large audience. While detailed coastal monitoring data is only available in Hastings for the last few decades, the data assessed above can help fill the large 'data gap' for the earlier periods from the Palaeolithic to the 20th Century.

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