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European Regional Development Fund

**SARCC**

**Newlyn Pilot Study:  
Report in  
Support of the  
Maritime Atlas**



# Newlyn Pilot Study:

## Report in Support of the Maritime Atlas

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## 1. Introduction

The Newlyn eco reef scheme is one of seven pilot sites within the SARCC project that are developing Nature Based Solutions to coastal management in urban settings along the 2Seas coasts. Full details of the Newlyn scheme are provided on the SARCC Website: <https://www.sarcc.eu/pilots/cornwall>. This report concentrates on presenting details in support of the Maritime Atlas which considers how data from archaeology, paleoenvironmental material, historical sources, art, charts, maps and photographs can provide vital information on long term coastal change. This, in combination with datasets on storms, flooding patterns and sea-level changes, ensures schemes incorporating Nature Based Solutions for coastal management have the full benefit of hind-sight when planning for future changes.

Humans have interacted with the environment and landscape for thousands of years during which time the coastline has changed and evolved. The coast has been attractive for human use due to a wide range of social and economic reasons which include trade and defence, and in the last few centuries tourism and leisure activities. The resulting construction of settlements which have grown into urban centres and conurbations and their shoreside harbours, facilities and buildings have then required the establishment of coastal defences to prevent flooding and damage.

Many coastal defence structures have sought to fix the position of the coastline to protect adjacent homes, businesses and infrastructure. However, increased erosion, instability and flooding problems mean that options for defending the coast that work with nature rather than installing hard defences are increasingly being reviewed as options, which is the case at Newlyn.

This report introduces the pilot area with Section 1 providing data on geomorphology, coastal processes and environmental impacts. The results of the results of the archaeological and palaeoenvironmental study and scoring are then presented (Section 2), followed by the maps and charts (Section 3) and then the pictorial resources – art and historic photographs (Section 4). The analysis of these results in combination as applied to a number of areas along the Newlyn frontage then demonstrate the scale and rate of coastal change and are presented in Section 5.

### 1.1 Introduction to Pilot Study Area

Historically the area around Newlyn and Penzance – Mount's Bay – has relied on static and inflexible coastal protection measures. The local shoreline is heavily developed and structures have modified the natural coastal system rather than working with it. The aim of the Newlyn eco-reef pilot is to reduce wave energy to promote the growth of the natural beach which will create a wider risk management zone.

The Newlyn eco reef scheme will be installed adjacent to the North Pier of the Harbour where the Coombe River exits across the foreshore (Figure 1). The structure will be constructed with a range of materials to help create opportunities for marine life colonisation to promote local scale ecosystems. The reef will help deliver a progressive managed realignment approach that assists in rehabilitating a more naturally functioning coastline in this high wave energy environment.

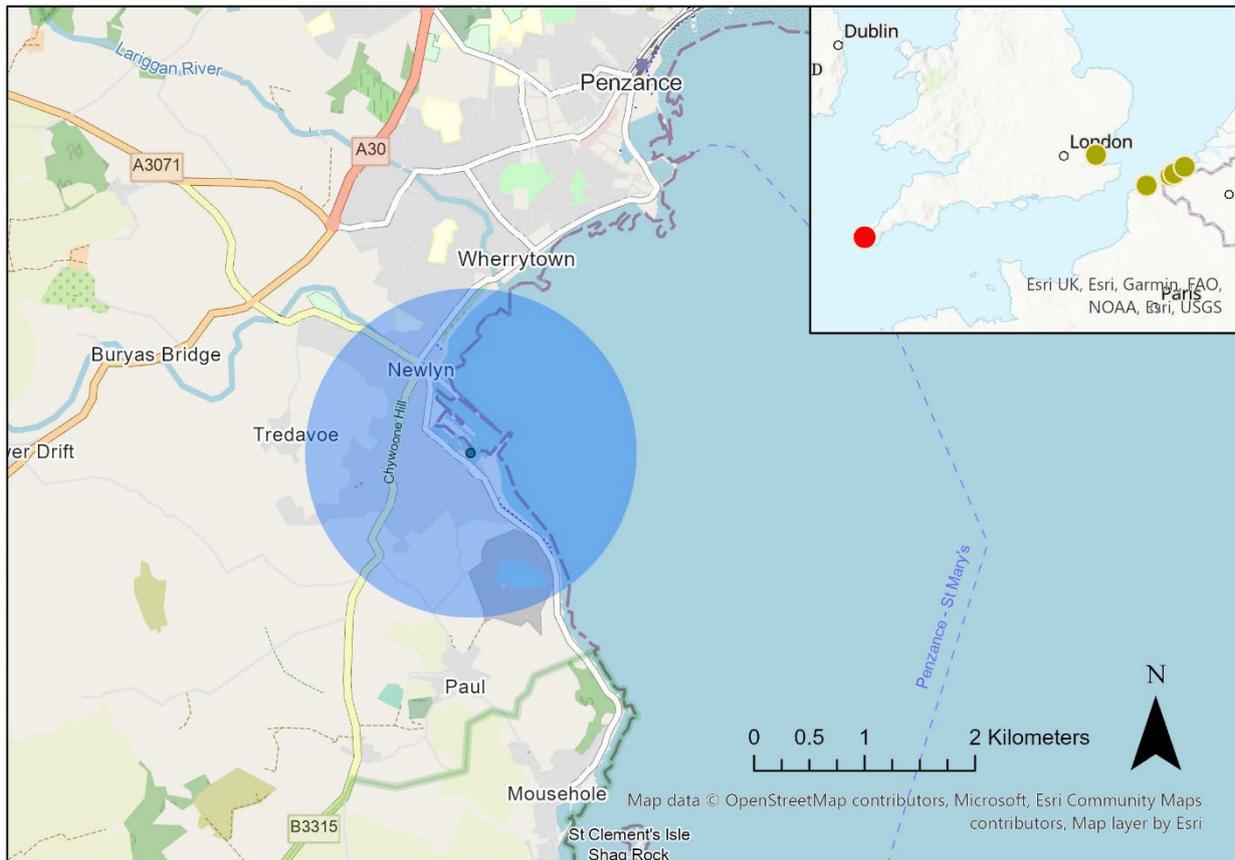


Figure 1: The location of the Newlyn Pilot Study area, inset map shows Newlyn (red) and the other SARCC Pilot Sites (green).

The study area used for the gathering of data and scoring of the various archaeological, historical and pictorial resources for the Maritime Atlas has ensured an area encompassing from around Penlee Quarry to the South East of Newlyn across to the foreshore area between Newlyn and Penzance has been reviewed. These resources have been scored and analysed to allow long-term trends of coastal change to be assessed in relation to human use and development of the coastal area.

### 1.2 Geology, Geomorphology and Sea-Level Rise within the Study Area

The Newlyn eco reef is located near the mouth of the Coombe River, adjacent to the North Pier of the Harbour; to understand the long-term changes that have occurred to this area of the coast in the past and likely future impacts it is necessary to have a wider understanding of the geology that under-pins the area and geomorphological changes that have taken place.

The coastline of south Cornwall, extending from Polperro past Lizard Point and into Mount's Bay, provides a dramatic contrast of rocky headlands and sheltered coves where the coastal geology is dramatically exposed (Natural England, 2014). The whole of this coastline is extensively designated on account of its outstanding geological exposures, its nature conservation interest and, more widely, as an Area of Outstanding Natural Beauty (Natural England, 2014).

West Cornwall is dominated by its granite backbone, which was formed during the Variscan Orogeny. To the east the Upper Devonian Slates occupy an extensive part of the county. Being located on a peninsula, the coastline is exposed to the full force of Atlantic storm waves, however, the coastline is composed of highly resistant rocks that, whilst susceptible to occasional rock falls, are generally steep and form impressive coastal landscapes.

Newlyn lies at the foot of a deep sided basin and has the shelter of the deep water of Gwavas Lake, it is protected from the prevailing weather by the high ground of the Penwith Peninsula to the west and north west. Newlyn is on the western edge of Mounts Bay which is visually dominated by St Michaels Mount which is composed from granite but the majority of Mounts Bay is formed from Devonian slate. The Mount acts to trap sediment on its western side and provides some shelter from wave action to the Marazion frontage.

Sediments in the Newlyn Coombe area consist of thin patches of sand over natural bedrock, with some loose rock (which may derive from previous coastal works along the harbour arm) and some mixed shingle. There are also areas where earlier (prehistoric) land surfaces and associated peat deposits have been preserved within the foreshore, being occasionally exposed following storm events. In the Coombe area there are limited sediments available and the foreshore is of lower amenity value than elsewhere along the frontage.

Sediment transport at Newlyn Coombe is constrained by the harbour cutting off sediment supply from the west. Longshore sediment transport at Newlyn is predominantly driven by storm events, with eastward transport occurring when waves arrive from the south/southwest, and westward when waves arrive from the east/south east. The Shoreline Management Plan suggests that there is minimal net longshore drift within this unit and that sediment transport is predominantly cross-shore.

Understanding the long term development of the Coombe river and the associated modern, and earlier palaeo valley is vital to put the pilot area within its context and to understand the impact of past changes on the current regime and the ways that the installation of the pilot eco reef might impact on historic structures and preserved deposits.

Since the last ice age sea level has been rising continuously. Ten thousand years ago sea level was approximately thirty-five meters lower than at present, and by the Roman period it was around three meters below present levels (Cullingford 1998). This has had an impact on the landmass available for human populations and has meant we have had to adapt to changing sea levels for many millenia.

The post glacial rise in sea levels during the Holocene affected sheltered bays and river systems. The rising sea level engulfed areas of woodland that would have once been on the coastal plains. Deposits of these now submerged and preserved forests are found at numerous locations around Cornwall, including across Mounts Bay, and close to the Pilot Study site to the east of the Combe River mouth on Wherry Beach (Arch Site ID 3313).

A number of studies have been undertaken on peat deposits and associated palaeoenvironmental remains across Mounts Bay. At Marazion there was a build up of a marshy area, with basal organic rich deposits having been inundated by marine sediments relatively rapidly at around 4,500BP (Healy, M, 1995). Healy (1995) describes Marazion as a typical sequence with basal organic sediments resting on bedrock and overlain by a long sequence of marine sand. This is then overlain by a further organic deposit and then sand. He interprets these changes to be the result of coastal evolution linked to barrier dynamics, coastal sedimentation and the movement of relative sea level. The earliest organic horizon dates to 4370–4050 cal BC (Q-2779).

The position of Mount's Bay as a relatively sheltered, shallow area has resulted in the preservation of the above sediments and means that the position of the coastline would have been considerably further 'seaward' than modern day. From the Roman period onward the sea level has been relatively stable with further small rises, however, due to the shallow nature of Mounts Bay this may mean that the coast here has still be changing over the past 2,000 years. With increased human settlement and development particularly from the 18<sup>th</sup> century onwards, the 'fixing' of the coastline with defences has further consolidated the coastal position.

Newlyn has an important relationship with the long-term measurement of sea levels around the UK. The South Pier has been the home of the Newlyn Tidal Observatory since 1915 (Figure 2) and is the most important sea level station in the United Kingdom (Ordnance Datum Newlyn, ODN). It is the national height datum for the whole of Great Britain. Prior to this, extended measurement of high and low waters can be traced back to 1764 at Liverpool).

The mean sea level (MSL) recorded by a tidal gauge is called the relative sea level measurement. This is sea level relative to the heights of nearby benchmarks in either solid rock or buildings. As a result, a record of changes from the ocean can be obtained, such as that associated with climate change, and also from land level changes associated with geological processes such as Glacial Isostatic Adjustment (GIA). Records have shown that the MSL at Newlyn has risen at an average rate of 1.8mm/year (with a standard error of approximately 0.1mm/year), this is slightly more than in the north of the UK where positive vertical land movement due to GIA is important. It is also similar to the global average over a similar period. Based on evidence from other UK tidal gauges, and because of the land submergence at Newlyn due to GIA, it is believed that the absolute rate of sea level change in this region has been closer to 1.4mm/year during the 20<sup>th</sup> to 21<sup>st</sup> centuries (Woodworth et al 2009).



Figure 2: Newlyn Harbour South Pier with lighthouse and observatory at the end of the pier

### 1.3 Storms and Flooding Patterns

Although Newlyn's location means that it is sheltered from North and Westerly storms, it is exposed to southerly and especially south easterly weather. Coastal flooding and damage within the study area is caused by a range of factors, these include large scale storm events, particularly where these correspond with high tides, and also to significant surges. The summary of significant events below includes many storms and events which have caused significant damage along the coastal frontage. The list which inevitably has more detail from when written records are available, serves to show that the risk and impact of storms and the associated flooding is something that has been experienced by human populations through millennia.

#### **Early records**

- 11 November 1099 – The St Martin's Day floods caused much destruction throughout the south of England and the Netherlands. The Anglo-Saxon Chronicle records "The sea-flood sprung up to such a height, and did so much harm, as no man remembered that it ever did before". John of Worcester also recorded in the floods in *Chronicon ex chronicis* saying "the sea overflowed the land, destroying many towns and drowning many people as well as innumerable oxen and sheep". He records that at that time, St Michael's Mount was five or six miles from the sea and enclosed in thick wood.

#### **18<sup>th</sup> Century**

- 1703 The Great Storm – An extratropical cyclone battered southern and central England for a week, causing flooding in the West Country and Somerset levels, causing the death of between 10-30,000 people and thousands of animals. Many trees and buildings were destroyed including the First

Eddystone Lighthouse in Plymouth and 400 windmills. Many ships were destroyed at sea in and around Cornwall as well as across the whole south coast. Daniel Defoe recorded these events in his book "The Storm" published in 1704.

- 25 November 1738 – "*Severe storm when the weather was hard, stormy, and thick and a very great sea broke down a great part of the Newlyn Quay*". The original quay was built prior to 1337 (Newlyn Archive. The Story of Newlyn Harbour, Pgs 7&8).
- 1 November 1755 – The Mount's Bay Tsunami, arising from the "Lisbon Earthquake" which together with the resulting tsunami killed between 60,000 and 100,000 (BGS Report CR/07/077: A). The Cornish antiquary, geologist and naturalist William Borlase recorded his eyewitness account of the tsunami in Newlyn when water rose up to 10 feet in the harbour in his book *The Natural History of Cornwall* (1758).
- 1758 A large storm which exposed large tracts of prehistoric landscape material including trees in Mounts Bay (Camidge & Randall, 2009, Mount Bay Arch Survey CISMAS).
- 31 March 1761 – Resulting from a tsunami, widely observed including a detailed account in Mount's Bay, with references at St. Michael's Mount, Penzance Pier, Newlyn, Mousehole Pier, and Scilly (BGS Report CR/07/077: B). There was another event in July 1761. Both events were recorded by William Borlase.

### 19<sup>th</sup> Century

- 10 October 1809 and 8 November 1809 – Storm resulting in the loss of 11 vessels near Newlyn (Newlyn Archive. The Story of Newlyn Harbour. Page 8).
- 4 October 1859 – Reported in the *Royal Cornwall Gazette* of 7 October 1859. "*An Extraordinary Tidal Wave, or series of waves, swept into the Mount's Bay on Tuesday about half-past six in the morning. The first wave least five feet deep. On the Western shore of the Bay this tide was felt in full force at Newlyn and Mousehole*".
- 29 September 1869 – Reported in the *Hampshire Independent* of 2 October 1869. "*A remarkable tidal phenomenon was witnessed on the western coasts on Wednesday, when in several of the small harbours the tide rushed at the rate of five or six miles an hour, and then receded again as rapidly. The rise and fall amounted to five or six feet. Fortunately, it was a neap tide, or serious results might have followed. The run of the sea on the beach at Newlyn was from 90 to 100 feet*". (c.27.4m to 30.5m). The BGS dismissed this as tsunami event.
- 7 October 1880 – Reported in the *Western Morning News* of 8 October 1880. "*A fearful storm occurred during Wednesday night and yesterday morning on the south-west coasts. Penzance suffered most severely. At Newlyn no less than eight fishing boats have been sunk*".

### 20<sup>th</sup> Century

- 26 January 1917 – The *Cornishman* of 1 February 1917 included the following report. "*A heavy gale from the south-east has been blowing since Thursday, and tremendous seas have been running in Mount's Bay. No great material damage, however, in Wherrytown district the sea has come up and flooded their premises. People going to and from Newlyn have had to take the path through the fields, the water in the road between the eastern end of the Baths and Laregan river being several inches deep. The Tolcarne Inn at Newlyn also has felt the full effects of the gale, being flooded a considerable depth*".
- 7 March 1962 – This storm was reported by several newspapers as the worst storm in living memory which affected particularly Newlyn and Penzance. At Newlyn, the Harbour offices were almost breached. The storm unleashed itself on top of a flood tide followed by flooding from heavy rain. The area between the Tolcarne Inn in Newlyn along to the Jubilee Pool in Penzance was flooded. The sea wall at Tolcarne beach was being overtopped an hour before high tide. The sea front houses were evacuated prior to being flooded. At the western end of the promenade, the defences were damaged, cottages swept away and boats torn off their moorings (<https://www.surgewatch.org/events/1962-03-07/> accessed 22/07/2021).

## **21<sup>st</sup> Century**

Many of the more recent storms have been captured by video as well as photographs. Significant storms which have been captured on film include:

- 27 October 2004 – a video of the storm mostly outside the harbour..
- 11 March 2008, storm breaking over the South Pier.
- 2012 Newlyn Flood

The SW coast of England experienced 22 extreme storms from October 2013 to April 2014 (CH2M, 2018), these were felt at Newlyn with particularly severe days captured on the 5<sup>th</sup> February and 14<sup>th</sup> February. Storms have continued into the 2020s with Storm Bella being notable in 2020 and Storm Darcy in 2021. The frequency and impact of these more recent storms is further explored below.

### **Tidal and Storm Patterns and Impacts**

Tidal currents around the Newlyn area are generally weak and the typical daily wave climate is relatively low energy due to the Penwith Peninsula sheltering the area from the dominant south-westerly waves. However, the area can be impacted by large Atlantic swell waves which refract around the Penwith Peninsula producing nearshore wave heights exceeding 4 m. Occasional storms from the south-east also contribute to the overall wave climate. As well as causing overtopping and flooding which results in significant damage to residential and commercial properties (as was the case in the winter of 2013/2014), these storm events dominate local sediment transport.

It is worth noting the extent of the impacts from the 12 major storms that hit the region between December 2013 and March 2014. They caused more than £4million of damage, including damaging the railway line between Exeter and Taunton left Cornwall cut off. An article in Marine Geology reported that the oblique wave approach of these storms, resulted in strong littoral drift and beach rotation, leaving the beaches in the most eroded state since records began. The storms had a devastating impact on the fishing industry, with many of the boats unable to go to sea for nearly two months. The violent storms, coupled with very high tides caused damage to harbours, ports, infrastructure and sea defences.

In Newlyn, streets and homes around the Combe river and the seafront were flooded. Waves gauged holes in the sea wall, causing the collapse of the pathway between Wherry Town and Newlyn. Huge sheets of tarmac were lifted off the path and paving slabs lifted off the promenade and displaced. A large section of sea wall at Newlyn Green collapsed. Seaweed, pebbles and even the larger stones that used to form the old causeway were redistributed further up the beach and a considerable distance inland.

The major impact of this incident and continued pressure from storm driven flooding, is a major driver behind the development of the NBS Pilot as part of the SARCC project.

### **1.4 Current Environmental Impacts/ Threats & Management Approach**

The Environment Agency West Cornwall Catchment Flood Management Plan (2012) looked at a range of factors that could influence flood risk over the next 100 years and found that climate change has the greatest influence on future flood risk. The study found that for West Cornwall there will be 20% increase in peak flow in all watercourses due to climate change, and 11% increase in river flows due to land use change and a 5% increase in river flows in certain locations due to urban development. In the populated areas of Penzance, Newlyn, Porthleven and Mousehole, tidal flood risk is more significant.

Across parts of west Cornwall where there are durable rock formations that front the coast then erosion is less of a problem, however, as seen at Newlyn, coastal erosion can affect beaches, particularly after storm events. In the longer-term sea-level rise is fuelling more aggressive coastal erosion, squeezing beaches against hard cliff lines at the back of beaches, which can result in increased scour and, consequently, beach

lowering. Beach levels are closely monitored in order to assess changes that may be taking place and establish long-term trends.

Looking more closely at the Pilot Study site, in 1992 the Environment Agency constructed a 30 m long, 5 m high, breakwater in front of the mouth of the Newlyn Coombe to alleviate overtopping and flooding. The breakwater is located approximately 50m from the mouth of Newlyn Coombe along the existing harbour arm. However, overtopping and flooding have continued to be a problem and with rising sea levels are expected to worsen.

Historic aerial imagery taken over the last 16 years does not illustrate significant morphological variation or patterns at Newlyn Coombe, since the construction of the breakwater in 1992. Therefore, it is reasonable to assume that the current system has limited variation which is likely to be a product of the low volume of sediments and restricted sediment supplies to this area.

The Shoreline Management Policy (SMP) for Cornwall and the Isles of Scilly, has the policy for the Pilot Area as 'Hold the Line'. There has been a short list of options put forward to reduce the flooding at Newlyn which focus on dissipating the wave energy reaching the Newlyn Coombe. These include raising the existing breakwater to approximately 9.5 and 9 high, and extending the existing breakwater to between 50 m and 60 m. Another option proposes a new 140 m long breakwater be built 100 m seaward of the existing breakwater. All these options would improve flood resilience at the frontage.

The Newlyn Eco-Reef pilot being deployed as part of the SARCC project involves the use of low-carbon eco-reef blocks which will be used to enhance the existing breakwater, raising its height while providing a bespoke substrate for marine organisms to colonise and develop a living structure.

## **2. Archaeology & Palaeoenvironmental Background and Resource Scoring**

This section provides initial background to the palaeoenvironmental, archaeological and historic development of the area surrounding the Pilot Project to put its development into longer term context. It then presents the results of the scoring of a range of sites, buildings and features within the pilot study area to identify those which provide the most potential for informing on the scale and pace of coastal change.

### **2.1 Archaeology and History of the Pilot Study Area**

Evidence from prehistoric periods through to modern day includes a wide range of traces of the environmental changes through preserved deposits and land surfaces in addition to the many finds, traces of buildings and burials through to historic development of coastal hamlets then towns. This evidence provides the long-duree of human use and occupation at the shore, including how people have both influenced coastal change through structures and have themselves been impacted through storms and coastal changes.

#### **2.1.1 Early Prehistory (Palaeolithic and Mesolithic)**

No direct evidence from the Palaeolithic has been located close to the pilot area. Cornwall was only sporadically visited by groups of humans during this period, with the first continuous occupation starting around 10,000 years ago at the end of the last Ice Age – in the Mesolithic.

The impact of the end of the Ice Age and the melting waters causing massive landscape change is witnessed close to the pilot area through evidence of submerged prehistoric landscapes. These were first recorded by the antiquarian William Borlase (1769), with one example when he recounts the storm of 1758 when large tracts of tree stumps were revealed on the seabed at Long Rock by receding waters (Camidge & Randall, 2009).

More examples have since been identified and recorded at multiple locations around Mounts Bay. These preserved fossil forests and associated peat deposits provide very direct evidence of coastal change in response to sea level rise. Close to the Newlyn eco reef area, between Long Rock and Wherry Town a well-preserved fossil forest has been uncovered by recent storms, in particular in early 2014 and exposed again in 2021. Evidence that these submerged prehistoric landscapes extend offshore have been found through surveys which have identified erosional plains and valleys containing deposits of peat, sand and gravel. These deposits provide evidence of the changes from wetland to coastal forest, to brackish conditions that have been occurring over the past 12,000 years. The coastal plain may once have extended between two and five kilometers further south than today.

In terms of direct evidence of human occupation there are significant numbers of finds of Mesolithic material on the West Penwith peninsular, although they lie to the west of Newlyn. These demonstrate human occupation around the area that would have been contemporary with the coastal wooded environment before it was impacted by sea level rise. The submerged forest deposits in the intertidal area of Mounts Bay are of national importance and are part of a Cornwall Geology site.

### 2.1.2 Later Prehistory (Neolithic, Bronze Age and Iron Age) & Roman (AD43 – AD 450)

Evidence of occupation in Cornwall increases from the Neolithic period onwards. There are many megaliths in Cornwall, in addition to menhirs, barrows and hut circles. Within the Newlyn SARCC case study area a site of a potential Neolithic stone quarry is highlighted (Site ID 3273), which is in the current marine zone, however, at the time of potential use the position of the coastline would have been further seaward.

Cornwall had large reserves of tin which were mined extensively from the Bronze Age. The need for tin in the manufacture of Bronze meant that from around 1600BC Cornwall was prosperous from the export of tin across Europe.

Significant area of occupation 1km to the west of Newlyn at Faugan where a number of monuments include a Bronze Age Round and an Iron Age hillfort. These are on higher ground and would have had views and access over the water front area. Bronze Age implements and much pottery are the earliest evidence of a settlement in Penzance, the discovery was made during the building of a new housing estate at Tredarvah (Excavation News, 1963-1964). This evidence indicates that the Newlyn Pilot area would have been within a well-used coastal landscape at this time.

From 750BCE the Iron Age reached Britain, Cornwall was inhabited by Celts, known as the Britons, the Cornish language developed from the Common Brittonic spoken at this time. St Michaels Mount which sits within Mounts Bay, is believed to have been a trading post from the earliest times and an important port during the Iron Age, it is thought to be the island of 'Ictis' where the Greeks traded for Cornish Tin.

Cornwall was remote from the main centres of Romanisation, the road system did extend to the area but there are few known large Roman sites in Cornwall, those that have been discovered include three forts and a villa. In general, west of Exeter the native socio-economic system continued relatively unhindered by Roman occupation across wider Britain. In west Penwith, the wider area around Newlyn, a uniquely Cornish 'courtyard house' is found during this period, it has parallels with archaeological sites in Atlantic Ireland, North Britain and on the Continent and demonstrates how Cornwall maintained its maritime links with trading partners during the Roman period.

### 2.1.3 Newlyn from the Early Medieval to Modern (AD 450 – Present day)

Following the collapse of Roman rule in Britain, Devon and Cornwall held out as the British Kingdom on Dumnonia, while other areas were conquered and settled by Saxons. Cornwall maintained cultural contacts with Ireland, Wales and Brittany – all of which required the continued use of maritime routes of the West Atlantic.

Early Christian ‘saints’ appear in the history of Cornwall from the 5<sup>th</sup> and 6<sup>th</sup> centuries. By the 9<sup>th</sup> and 10<sup>th</sup> centuries there were multiple churches established, some with estates.

Relations with neighbouring Wessex would be fractious for several centuries. During this time Wessex was fighting Danish and Viking expansion on its other boarder. The precise chronology of English expansion into Cornwall is unclear, but by the 11<sup>th</sup> century it had been absorbed into England under Edward the Confessor.

Following the Norman conquest much land was seized and transferred to the new Norman aristocracy. Eventually Norman absentee landlords became replaced by a new Cornish-Norman ruling class, with many of these families being involved in the operation of the stannary parliament system.

The settlement of Newlyn is first recorded in 1279 as ‘Nulyn’, a name thought to derive from the Cornish for ‘pool for a fleet of boats’, this is likely to refer to the shallows offshore known as Gwavas Lake. In Newlyn the harbour is established by 1337, the original construction is thought to be preserved within the current remains, much of which dates to a rebuild and extension in 1732. The fishing trade was significant here from the 14<sup>th</sup> century.

Exports of pilchards from Newlyn are recorded from 1555, particular export market to Italy. A depiction of Mounts Bay from 1540 (Figure 3) shows the importance of the bay for maritime trade, and also shows the forms of the coast, harbours and adjacent towns. Zooming into the areas of Newlyn (Figure 4), allows us to gain an impression of the size of the settlement and the harbour at this period. Interestingly the chart includes several area of rocks which outcrop near the coast – including what appear to be those off the area of Wherry Town which are still visible today. The 16<sup>th</sup> century was a time of political wrangling and military responses; in 1595 a raid by the Spanish caused significant destruction in settlement on Mounts Bay including Newlyn.



Figure 3: Chart of Mounts Bay. South is upwards. It dates from around 1540. Ports from top right downwards are: Mousehole, Newlyn, Penzance. Harbour walls are depicted. (Source: The British Library, [Chart of Mount's Bay (Cornwall) Cotton MS Augustus I i 34 : 2nd quarter of the 16th century] <https://www.bl.uk/collection-items/mounts-bay-cornwall>) accessed 19/07/2021. Public domain.



Figure 4: Newlyn, as depicted within the 1540 chart of Mounts Bay (acknowledgement as above for Figure 3).

The town of Newlyn is based around what were three hamlets, the area of the Old Harbour was known as 'Newlyn' (until the 19<sup>th</sup> century) with Street-a-Nowan to the east and then Tolcarne further east again on the other side of the stream. Access between them was possible at low water across the foreshore, with the area only being permanently connected from the early 19<sup>th</sup> century when the area between the hamlets of Newlyn and Street-An-Nowan was reclaimed to create a road.

By the 17<sup>th</sup> century the pilchard industry was coming to the fore and the importance of Newlyn increased due to this trade. New development around Street-a-Nowan included distinctive houses which were used for the processing of fish, with accommodation above and the fish cellars below. The development doubled the size of 'Newlyn' and increased the population.

The old harbour was 'rebuilt' and extended in 1732, based on the original Medieval structure. Much of the 1732 construction is visible today (Figure 5). Qwavas Quay at Street-a-Nowan was also rebuilt at this time. More fish cellars and seine cellars were also constructed. Alongside the smaller dwelling there are also larger merchants houses being built, infilling areas and extending the town out into surrounding fields. There were also challenges faced during the 18<sup>th</sup> century with a number of tsunami related flood events which impacted Newlyn, these date to after the rebuilding of the Old Harbour which must have provided some protection for ships from the high waters.



Figure 5: The inside of the Old Harbour, with boats against the harbour wall. The New Harbour arms are visible in the background.

The development of Newlyn and neighbouring Penzance have been interlinked with both having harbours and associated fishing industries. When Penzance Harbour was busy then vessels would ground at the mouth of the Lariggan river and discharge their cargoes into carts. This area is known as Wherry Town and is situated between Penzance and Newlyn, the foreshore off 'Wherry Town' is bounded in the west by the Coombe River and in the east by the Lariggan river.

The reef at Wherry town was worked for tin deposits from the early 18<sup>th</sup> century. In 1722 while staying in Penzance Daniel Defoe remarked on the 'veins of lead, tinn and copper ore [which] are said to be seen, even to the utmost extent of land at low water mark, and in the very sea ....'. In 1778 a shaft was sunk on the rocks below the high tide mark and protected with a stone breakwater to keep the sea out, in the 1790s a steam engine was built onshore to drain the mine. Operations stopped in 1798 either due to damage from a ship on the mine head, damage from storms, or to declining returns on the mine – there are conflicting sources. The mine was reopened in the 1830s when a new pier and engine were constructed. An account of the mining provides some useful information on the foreshore: "At that time there were low, grass, towans and the high-water mark was seaward of the present promenade. The water around the mine was not as deep as it is now, the shore was covered in sand and gravel with the nearby Laregan rocks covered in sand and the Lariggan stream flowing to the west of the rocks. By the side of the road from Newlyn was a ropewalk. The destruction of the towans began with the laying of the foundations for the engine house, count house (offices) and smiths' shop. Operations ceased in 1840 and the engine sold at auction. The stone from the engine house, chimney stack and walls was used to build houses in what became the village of Wherrytown".

This provides information on the foreshore deposits, changes from the removal of the 'towans' and indicates that the Lariggan stream was at this time flowing out to the west of the rocks. A storm in the 1880s changed the course of the Lariggan stream to the east of the reef and caused erosion to the sea wall, this was also blamed on the continual removal of sand from the beach for use in agriculture.

On the 7 October 1880 the seawall protecting the drill hall, granary and a smith was levelled by the sea for more than 50 feet (15 m) and all three buildings and dwellings flooded. The road to Newlyn was also swept away.



Figure 6 also provides information on the changing harbour front with the new roadway/ viaduct shown with 'reclaimed' land behind clearly labelled. The installation of the new harbour had a significant impact on the adjacent shore sides.

While tourism developed across Cornwall, Penzance was more of a focus for this with the building of a promenade and then the coming of the railway. Although Newlyn also attracted tourists, it has more of a fishing focus. In the late 19<sup>th</sup> century Newlyn attracted the attention of artists and a creative colony which became the 'Newlyn School' was established (see Section 4.1.1 for more detail).

### **20<sup>th</sup> Century**

The development of the fishing industry continued with more fish stores being built between 1901 and 1906. By 1907 the fish market had moved to its present site. The large Ice Works building was also constructed at this time. A new Arts and Crafts style Royal National Mission for Deep Sea Fishermen was built at the head of the North Pier adjacent to what had become a new more urban centre at the end of the Coombe at Tolcarne. The Coombe had previously been more of a suburb of Newlyn where industries such as smithies, timber yards and mills were located.

Other local industries of quarrying and minerals developed, with the harbour being used to export products. A tramway was built from Penlee Quarry to the South Pier from around 1900 for the stone trade. During the First World War the area to the south of South Pier was used as a seaplane base.

Further upgrades to the fishing facilities within the harbour have continued through the later 20<sup>th</sup> century. Today Newlyn is one of the UK's largest fishing ports and the working nature of the harbour continues.

## **2.2 Results of Archaeology Scoring**

This section outlines the results of the archaeological and palaeoenvironmental scoring from the Newlyn study area, followed by a discussion of the results. The scoring methodology applied is detailed in *SARCC Maritime Atlas: Methodology Report* (MAT 2022). It should be noted that the scoring is not providing any measurement of historic or cultural significance of a site, only its potential to inform on coastal change.

Within the pilot area data was obtained from the local Historic Environment Record (HER), the United Kingdom Hydrographic Office (UKHO) and the English Heritage Peat Database. Where HER data indicated there were sites with potential to inform on past change then further research was required in order to understand the full nature and extent of the site. A total of 199 sites were assessed and scored.

The highest combined scoring sites are shown in Figure 7 and listed in the table below, the total score has been normalised to give each site a score out of 100. It is possible for a site to score highly in one of the three scoring categories and still be important for informing on coastal change over time. The combined approach identifies those scoring highly across the scoring categories.

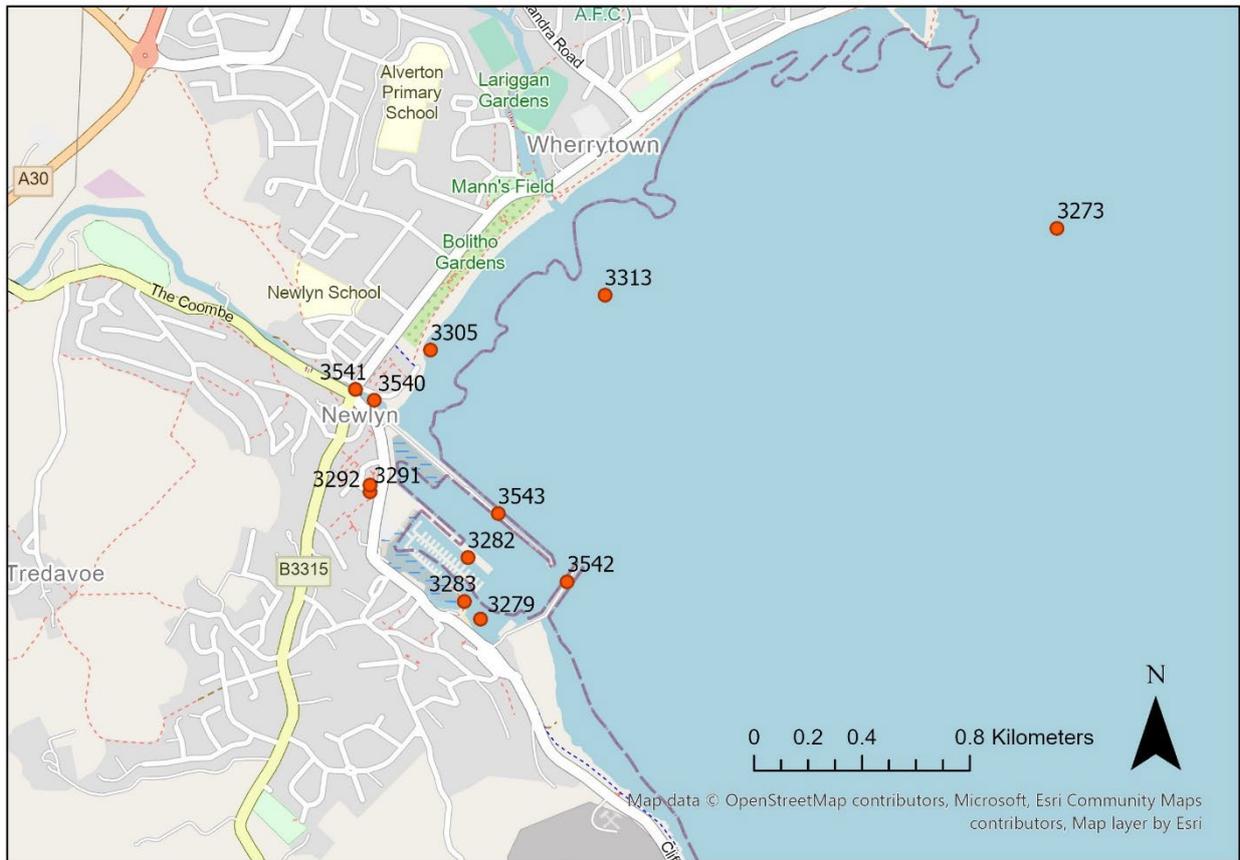


Figure 7: showing the distribution of the highest scoring archaeology and palaeoenvironmental sites in the Newlyn study area.

### Highest scoring sites based on total score

ID	Site Name	Site Type	Period	Score – sea level	Score – Environmental	Score – Temporal Continuity	Total Score	Coastal Context
3313	Wherry Town - Prehistoric submarine forest		Prehistoric	High	High	High	100	Marine (below low water)
3305	Newlyn - Early Medieval peat deposits & Post Medieval sea defences		Early Medieval	High	High	Medium	88	Inter tidal
3540	Tolcarne Bridge (Old)		Saxon	Medium	High	High	88	Above high water
3541	Heritage bridge at Tolcarne (New Road)		Post-Medieval	Medium	High	High	88	Above high water
3542	Newlyn Post Medieval South Pier		Post-Medieval	Medium	Medium	Medium	66	Inter tidal
3543	Newlyn Post Medieval North Pier		Post-Medieval	Medium	Medium	Medium	66	Inter tidal
3273	Penzance/ Newlyn - Neolithic working site		Neolithic	High	Medium	Low	66	Exposed bedrock
3279	Newlyn - Medieval wreck		Medieval	Medium	Low	Medium	55	Inter tidal
3282	Newlyn - Medieval harbour		Medieval	Medium	Low	Medium	55	Inter tidal

3283	Newlyn - Medieval breakwater, Post Medieval quay		Medieval	Medium	Low	Medium	55	Above high water
3291	Newlyn - Post Medieval slipway		Post-Medieval	Medium	Low	Medium	55	Above high water
3292	Newlyn - Post Medieval harbour		Post-Medieval	Medium	Low	Medium	55	Above high water

*Table: Archaeological and palaeoenvironmental sites with high potential for informing on coastal change, all sites with a total score of 55 or above.*

### 2.3 Discussion of Scoring Results

The table of highest scoring sites includes a range of sites and landscape deposits. Those scoring highest were the submerged prehistoric forest and associated deposits (Site ID3313), these deposits are in-situ and are exposed when storms remove sand from the foreshore. The record which encompasses early medieval peat deposits and post medieval sea defences (Site ID3303) also scores very highly, again the presence of peats which can be dated provides a record of the position and height of sea level at a particular time. The analysis of peat deposits provides very detailed information on the environment including the flora and fauna, but also the extent to which the water conditions were fresh, brackish or marine – which provides data on how the environment has changed in response to sea level rise at a particular dated period.

The site of a potential Neolithic stone quarry site (Site ID 3273) which is showing as in the modern day marine zone helps understand the extent to which the position of the shoreline has changed since the prehistoric period. During the Neolithic the rock outcrops being used for stone would have been part of the terrestrial landscape.

A range of structures which are very much linked to the water levels – the arms of New Harbour (Figures 11 and 12), phases of building of the Old Harbour (Figure 10) and two bridges over the Coombe River (Figure 8 and 9) all feature within the highest scoring sites. As these historic structures are in existence today they can be used as markers against which changes in the adjacent coastal sediments and foreshore profiles can be measured.

A range of other sites which scored lower as a total score feature within the dataset. It is possible for a site to score highly on one of the categories and within that still have the potential to help understand changes over time.

### 2.4 Photographic Survey of High Scoring Features

Some of the sites and features that scored highly are in existence today and are above the low water mark so can be viewed/ visited. A site visit was undertaken to capture current day images of a number of the archaeological and historic features, a range of key examples are included below (Figures 8 – 12). These can now be used to directly compare with other available resources to demonstrate the extent to which there have been changes to the coastal and harbour area.



*Figure 8: Old Tolcarne Bridge (taken from Jack Bridge – which is the bridge closest to the river mouth)*



*Figure 9: Tolcarne New Road Bridge looking up stream (taken from Old Tolcarne Bridge).*



*Figure 10: Medieval/ post-medieval harbour, within the New Harbour.*



*Figure 11: The inside of the North Harbour arm*



*Figure 12: South Harbour arm*

### 3. Maps and Charts

This section provides a background to the development of maps and charts over time which have relevance for the area surrounding the Pilot Project. It then presents the results of the scoring of a range of maps and charts which cover the pilot study area with details that allow them to help demonstrate changes to the coastline over time.

#### 3.1 Maps and Charts Background/ Map Progression

Understanding the development of the practice of mapping the land and charting the marine area provides the context within which to understand the maps and charts themselves which were often produced for differing purposes. It also allows us to understand the amount of detail in which the coast may be depicted and other features – roads, buildings, towns, landmarks, sea markers etc – which can provide evidence of changes over time. This information enables the charts to then be scored through the system used for the SARCC project.

#### **Maps of the British Isles**

The first known map of the British Isles, known as the Gough map, is believed to have been drawn in 1360 (Figure 13), though who created it and how is unknown. The name Gough relates to Richard Gough, one of its antiquarian owners. The map is held at the Bodleian library in Oxford. Newlyn is not marked on the Gough map, but Penzance is represented by a single building.

The Anglia Figura, drawn on vellum in 1536 (Figure 14), is considered to be the one of the earliest accurate maps of the British Isles and is thought to have been hung in the palace of King Henry VIII. Today, it is held by the British Museum. Cornwall is depicted, although the level of detail is low.



Figure 13: By Unknown author - [www.goughmap.org](http://www.goughmap.org), Public Domain, <https://commons.wikimedia.org/w/index.php?curid=3499458> accessed 06/07/2021



Figure 14: The Anglia Figura. 1537. Public Domain. Source <https://blogs.bl.uk/magnificentmaps/2014/07/tour-de-british-library-a-historic-journey.html> accessed 22/07/2021)

Map making was boosted by the Italian invention of printing from copper plates and scientific developments saw the Dutch and Flemish cartographers emerge as master map makers in the late 1500s. The first known map of Britain printed from Copper Plate was the *Britanniae Insulae* by George Lily in 1546, Mount St Michael is marked (Figure 15). The famous Flemish master cartographer Gerardus Mercator published a map of the British Isles in his 1596 world atlas (Figure 16), this shows Penaznce marked and has a little more detail of the form of Mounts Bay (see inset on Figure 16).

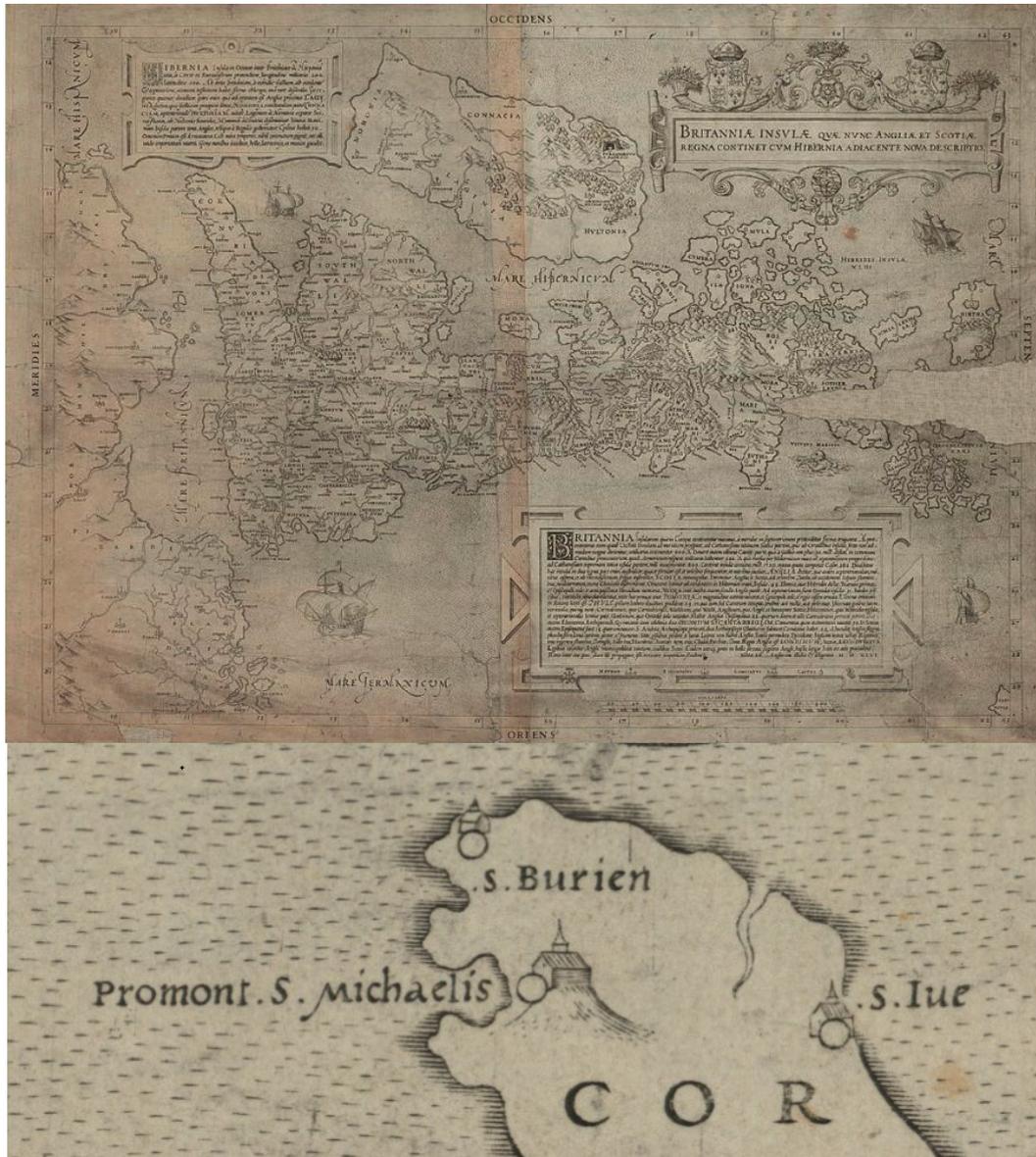


Figure 15: (Upper) *Britanniae Insulae* By George Lily - 10.3931/e-rara-12279 : Info: Kartenportal.CH, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=42470692> accessed 22/07/2021. (Lower) Close up showing the depiction of Mounts May and St Michaels Mount.



Figure 16: Gerardus Mercator, 1596. Public domain, via Wikimedia Common Accessed 22/07/2021s  
[https://commons.wikimedia.org/wiki/File:Atlas\\_Cosmographicae\\_\(Mercator\)\\_047.jpg](https://commons.wikimedia.org/wiki/File:Atlas_Cosmographicae_(Mercator)_047.jpg)

### County Maps

The first series of county maps of England and Wales were commissioned by Lord Burleigh, the chief advisor of Queen Elizabeth, in 1573. He appointed Christopher Saxton, a Yorkshire estate surveyor and cartographer, to the task. Saxton's map of Cornwall (Figure 17) was published in 1579 within *An Atlas of England and Wales*. This was the first atlas published of any country and the quality and accuracy of the maps were a landmark in British cartography, and remained the basis of mapping for the next hundred years. These topographical maps show relief, water, vegetation, settlements and notable buildings. Villages are represented by a building with a spire, whilst towns are shown by groups of buildings. Newlyn is now named, together with Penzance and Mounts Bay (Figure 18).



Figure 17: Christopher Saxton 1579 Source: [https://upload.wikimedia.org/wikipedia/commons/f/f1/Cornwall\\_-\\_Christopher\\_Saxton%2C\\_1579%2C\\_5\\_-\\_BL.jpg](https://upload.wikimedia.org/wikipedia/commons/f/f1/Cornwall_-_Christopher_Saxton%2C_1579%2C_5_-_BL.jpg) Creative Commons CC0 1.0 accessed 22/07/2021



Figure 18: Close up of the Mounts Bay area of Saxton's 1579 map, Newlyn is marked on the map (attribution as for Figure 17)

Saxton's maps were eventually replaced by John Speed's maps. Speed produced an individual map of every county in Great Britain, divided into hundreds. The maps also contained heraldic shields and most significantly, one or two town plans and a text description of the county on the back. The map of Cornwall was published in the *Theatre of the Empire of Great Britaine* 1611/1612 (Figure 19). Newlyn, Mounts Bay and the surrounding area are shown in detail (Figure 20). The maps were engraved by the Dutch master Jodocus Hondius. Speed's maps became the basis for world maps until the mid-eighteenth century.

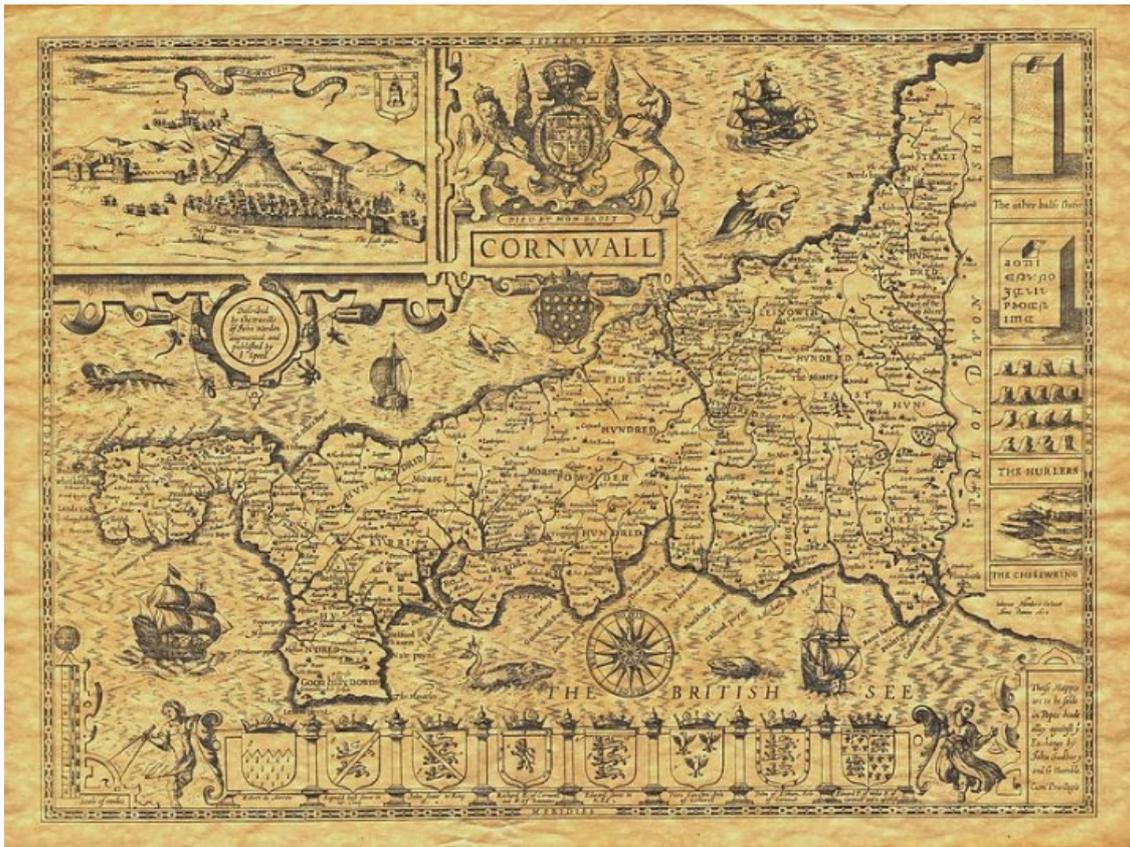


Figure 19: Speeds Map of Cornwall 1614 [https://commons.wikimedia.org/wiki/File:John\\_Speed\\_-\\_Map\\_of\\_Cornwall\\_-\\_1614\\_-\\_001.jpg](https://commons.wikimedia.org/wiki/File:John_Speed_-_Map_of_Cornwall_-_1614_-_001.jpg) Public domain. Accessed 22/07/2021

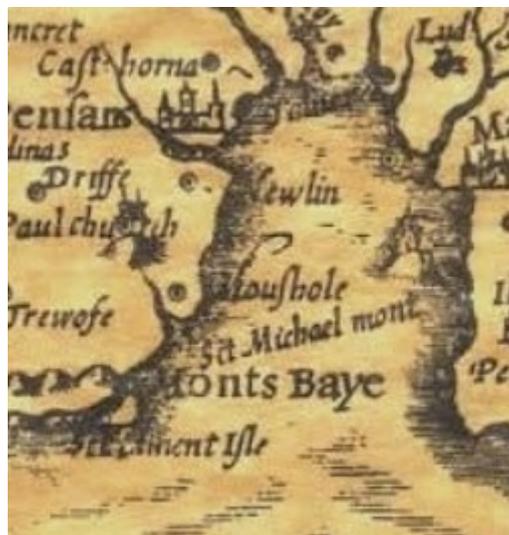


Figure 20: Close up of the Mounds Bay area from Speed's map of Cornwall, Newlyn is depicted (attribution as per Figure 19)

In 1681, King Charles II commissioned Captain Greenville Collins, an English Captain and Naval Officer, to survey the coast of Great Britain. The result was a publication titled '*Great Britain's Coasting Pilot. Being a New and Exact Survey of the Sea-Coast of England*' it contained tide tables, coastal views, and 49 sea charts of the coasts of England and Scotland, one of which was of Fowey and Mounds Bay. The sea charts were not very accurate, but they were certainly an advance against older charts. Buildings are shown on the coast in the position of Newlyn, though the town is not named (Figure 21), there appears to be the harbour arm show to the south of the main cluster of buildings.

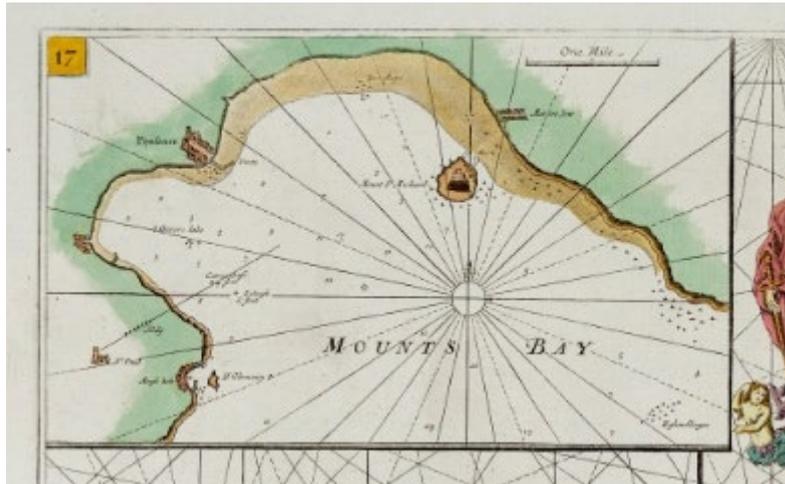


Figure 21 Extract from Collins Chart of 1681 (Source:<https://www.vintage-maps.com/en/antique-maps/sea-charts/collins-england-cornwall-mount-s-bay-fowey-1693-1792::11780> accessed 22/07/2021)

In 1780, John Thomas and William Denys surveyed Mounts Bay (Figure 22). The copper plate engraving was published in Sayer and Bennett's *A complete Channel Pilot*. This map can be viewed online at the National Maritime Museum at Greenwich. This time, Newlyn and Gwvas Lake are named and the harbour shown, the beach area is also depicted (Figure 23) as are the Coombe and Larigann Rivers. The 'coastal views' included on the chart include the approached to Mounts Bay (top right middle image).

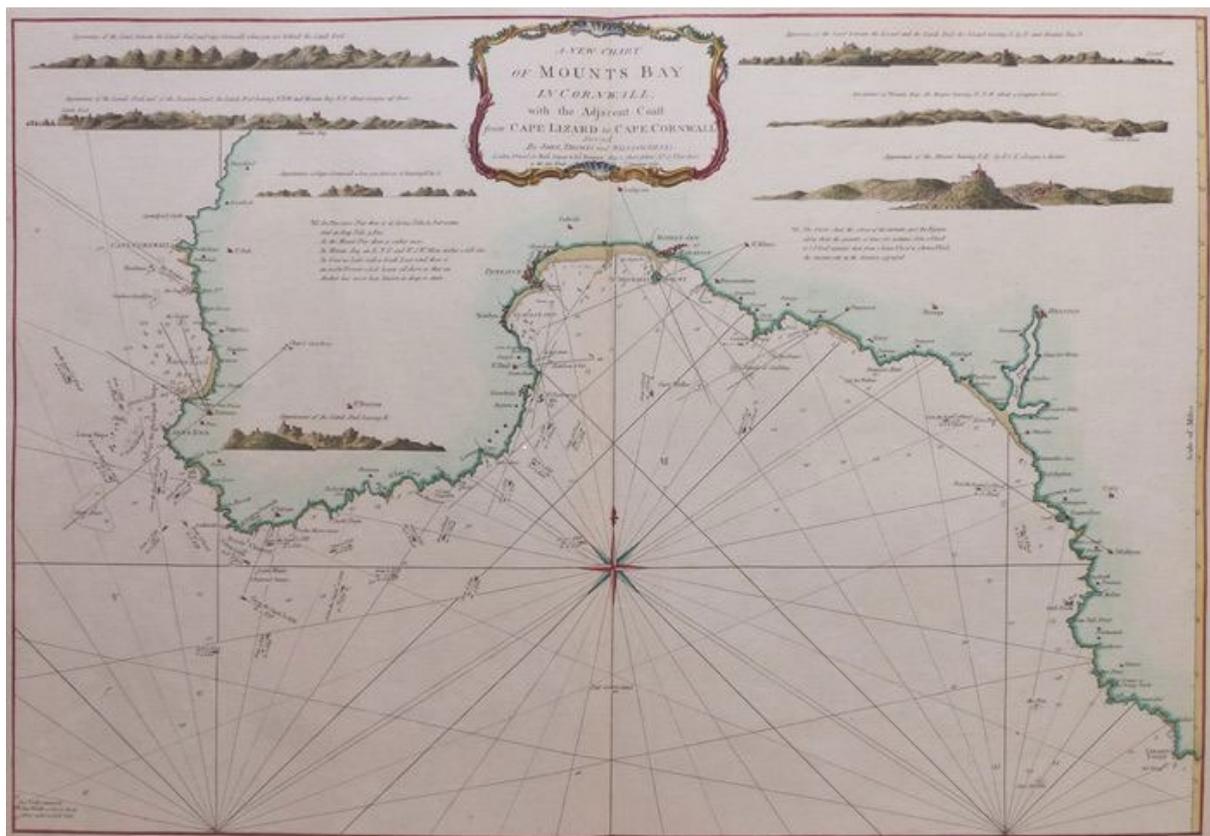


Figure 22: Thomas and Denys survey of Mounts Bay (Source <https://collections.rmg.co.uk/collections/objects/565508.html> © National Maritime Museum, Greenwich, London Accessed 22/07/2021)

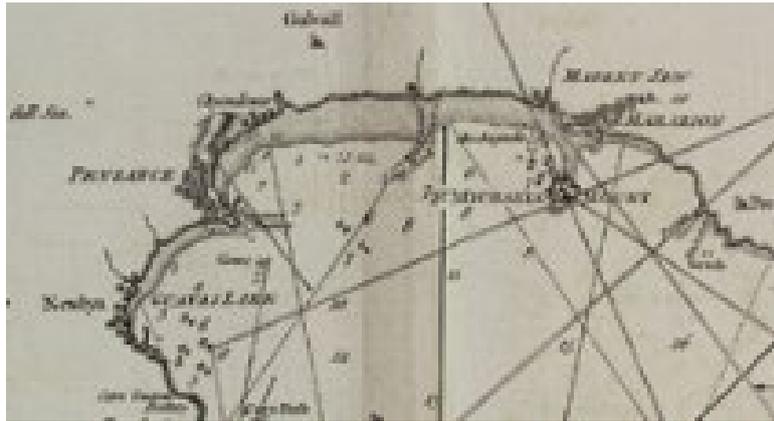


Figure 23: Source <https://collections.rmq.co.uk/collections/objects/565508.html> © National Maritime Museum, Greenwich, London Accessed 22/07/2021

In 1809, John Hewitt surveyed the defences of Mounts Bay. His 6 foot to the mile scaled chart highlights the areas status as a key defence point. The positions and weights of cannons are marked together with the artillery on St Michaels Mount. Sand is marked with dots and rocks are indicated by intersecting lines. An engraved sketch map of Penzance Bay by Perron dated 1885 records geomorphological detail of the coastline, and the depth of water; Newlyn is clearly marked.

#### **Tithe Maps**

Following the Tithe Comutation Act of 1837, the whole of England and Wales was surveyed and details of land usage, occupation and ownership recorded. The tithe map of the Parish of Newlyn (SW 839564) was produced in 1839 by Thomas Woodmass, John Thompson, John Huddleston and John Woodmass. It recorded footpaths, bridleways, houses and field boundary ownerships. This map is held by the Archives and Cornish Studies Service (no image available).

#### **Ordnance Survey Maps**

The Ordnance Survey was responding to the threat of invasion from France when it began mapping the vulnerable coastal areas of Britain. The first map of Cornwall was produced using theodolites by the Ordnance Survey in 1887. The six inch scale County Series Ordnance Survey maps are the most detailed. In this series, eight maps (4 publications) cover Newlyn in the late nineteenth /early twentieth century. Newlyn falls on the divide between sheets CORNWALL LXXIV.SW and CORNWALL LXXIV.NW. The survey was undertaken in 1876-77 and published in 1887, on this map, the low tide footpath between the beaches is marked (Figure 24). The old Harbour falls on the SW sheet. Rocks and sand and the high and low water levels are marked.



Figure 24: Extract from Cornwall LXXIV.NW Survey 1876-77 and published 1887. (Reproduced with the permission of the National Library of Scotland)

The 1906 revision (Cornwall LXXIV.NW surveyed 1906, published 1909) (Figure 25) shows the coastguard station, both the north and south piers of the New Harbour and the lighthouse. The SW Sheet shows the tramway running the length of south pier to Carn Gwavas. Later OS maps continue to increase the detail of the area and show the growing town and changing coastal frontage.



Figure 25: Extract from Cornwall LXXIV.NW Revised 1906, published 1908 (Reproduced with the permission of the National Library of Scotland)

### 3.2 Results of scoring

The ranking system for maps and sea charts as set out in *SARCC Maritime Atlas: Methodology Report* (MAT 2022) and has been applied within the Newlyn pilot area. A range of historical maps and charts of the Mounts Bay and Cornwall area, were assessed as part of the project, with some dating back over 500 years.

The study of maps and charts has utilised a range of online resources, it has been designed to show the potential of this type of resource for coastal change, but it is not an exhaustive study as other examples exist within archives, museums, libraries and galleries that is has not been possible to access due to Covid-19 restrictions. Sixteen maps and charts were analysed through the scoring system, the top scoring examples are detailed below:

MAP _uid	Title	Year	Score Chronometric Accuracy	Score Topographic Accuracy	Score Detail in non-coastal area	Score Geometrical Accuracy	Total Map Score
160	Newlyn Penzance.	1960	77.78	100.00	66.67	73.33	79.44
159	Penzance cornwall LXXIV.NW.	1887	63.89	66.67	66.67	73.33	67.64
157	Mounts Bay Cornwall LXIV.8,	1937	16.67	66.67	66.67	100.00	62.50
367	St Agnes Head to Gerrans Bay, W.J.L. Wharton	1882	50.00	66.67	33.33	100.00	62.50
156	Mounts Bay Cornwall LXIV.6.	1908	33.33	66.67	66.67	73.33	60.00
368	Admiralty Chart no 2345 Penzance Bay, H.P. Douglas	1931	50.00	33.33	33.33	100.00	54.17
165	Mounts Bay,	1903	38.89	33.33	33.33	100.00	51.39
166	Newlyn Sea Front, Penzance 1885	1885	19.44	33.33	66.67	81.82	50.32
369	Chart of Mounts bay (Cornwall).	1525	33.33	33.33	16.67	100.00	45.83
164	Mounts Bay	1856	29.17	33.33	33.33	81.82	44.41
153	Mounts Bay Cornwall,	1540	37.50	33.33	33.33	73.33	44.38
162	Penzance Bay	1885	33.33	33.33	33.33	73.33	43.33

Table: Results of the top scoring maps and charts for the Newlyn Pilot Area.

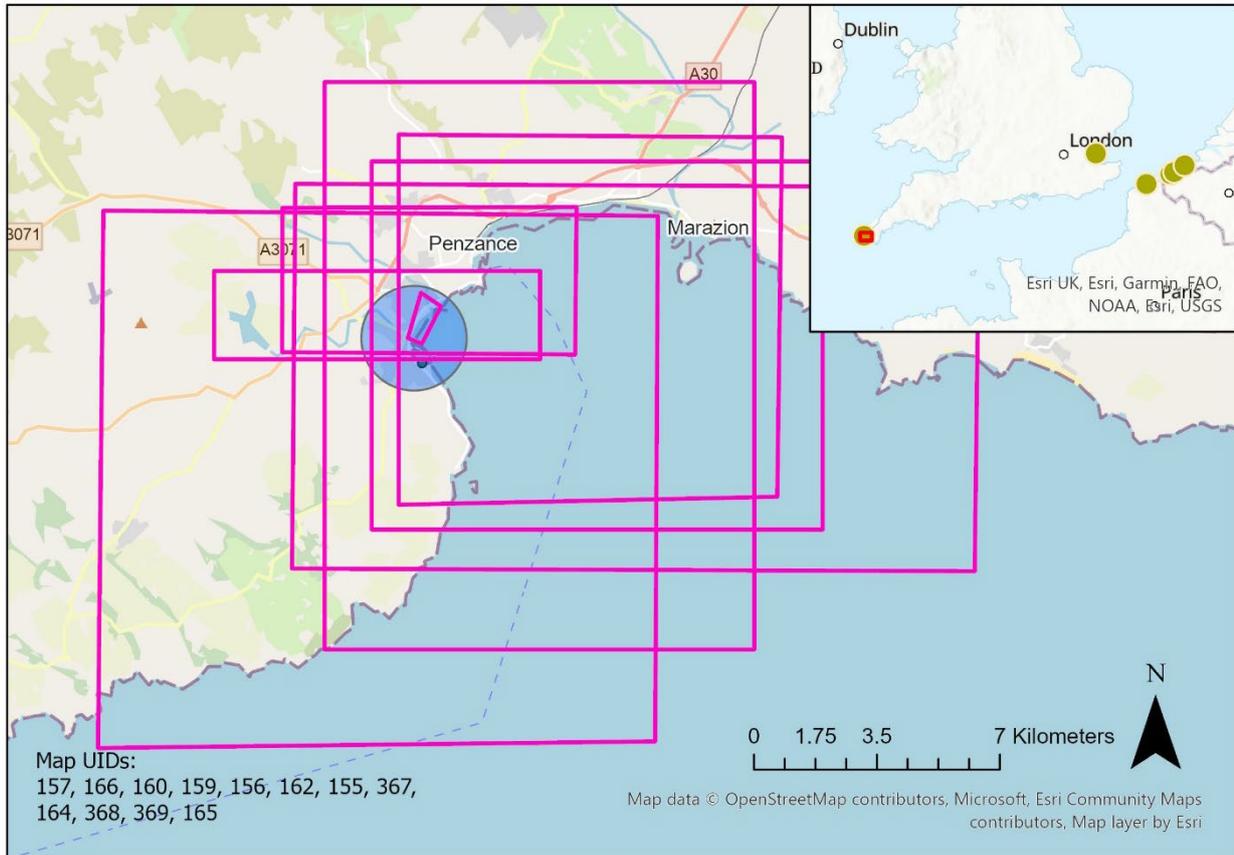


Figure 26: Area covered by the highest scoring maps and charts within the Newlyn Pilot Study Area.

### 3.3 Discussion of scoring results

Four of the top five scoring entries for the area are Ordnance Survey maps (IDs 160, 159, 157 and 156), this is not surprising due to the known accuracy and comprehensive nature of these maps, they include areas of the foreshore showing the levels of high and low water as well as features within the intertidal zone. They are highly reliable maps which can be used to plot coastal change, however, the earliest of this sequence dates to 1887 (see Figures 24 and 25 for examples of Ordnance Survey maps of the area).

It is also not surprising that the fourth highest scoring entry is an Admiralty Chart of 1882 (ID 367), by this period the practice of charting the coastline had developed significant accuracy and these can be relied upon for their depictions of the coastline and the near and offshore hydrography.

One of the earliest maps which appears in the table of high scores is the 1525 Augustus Cotton map of Mounts Bay (ID369) which is thought to depict a potential invasion scenario (see Figure 3). This very detailed depiction shows the old Harbour and buildings of the town, it also has detail of the beaches and some of the large rock formations that lie in the marine zone close to the coast. There are a number of other earlier charts which provide a differing perspective of the coastline than maps and can be important sources of information on coastal features, particularly harbour facilities, landing places and coastal landmarks. One example that doesn't make the top scoring list is the 1780 Sayer and Bennet published 'Mounts Bay' that was surveyed by Thomas and Denys (Figure 22).

## 4. Pictorial Resources Scoring

This section presents the results of the research, scoring and analysis of artistic images and historic photographs. The scoring approach for these resources has been developed to take account of the various styles, approaches and potential subjectivity (particularly of art images), and the potential of the resources to provide information on coastal change.

Artistic resources provide a similar time-depth to maps and charts in terms of the periods over which they have been produced, with photography being available for periods from the mid – late 19<sup>th</sup> century. Whereas maps and charts were designed to be as accurate as possible in producing 'plan views' which include the coast, art and photography provide a range of landscape and oblique views which give a different type of evidence of coastal change.

### 4.1 Artistic Images

The use of artistic images to help understand coastal processes, measure coastal change and inform approaches to coastal management has been developed over the past 20 years. Initial reports focused on the use of art resources to demonstrate coastal change in relation to issues for life and for economic assets (McInnes & Stubbings 2010, 2011; McInnes & Benstead, 2013, 2013, 2015). They demonstrated the potential for the resource to provide more data on other aspects of coastal management. The use of art images alongside archaeology and heritage data was further developed through the Arch-Manche project (<https://archmanche.maritimearchaeologytrust.org/>) which focused on long-term coastal change and included the assessment of artwork, cartography and photograph for more recent periods.

The assessment of art resources for the SARCC project draws on the art history of the South Cornwall area as detailed within the Arch-Manche project and an additional study for Historic England, the CHERISH Project, which included an assessment of artistic resources to determine which historic assets might be most sensitive to coastal change. As the Newlyn Pilot Area focuses on a smaller area than previous studies further research was undertaken to identify a greater number of art works depicting the area over time, which revealed more locally based artists working within the area.

This section outlines the art history relevant for the Newlyn Pilot Area before looking in detail at the high scoring art works, what these examples show us and how modern photos can be compared to the artistic views.

#### 4.1.1 Art History/ Resource of the Pilot Area

This section presents the background to artistic representations within the area including the 'Newlyn School' and significant individual artists. This provides the background to the consideration of the high scoring individual artworks within the study area. This section draws on the work of Professor Robin McInnes, particularly his contributions within the Arch Manche Project which had Penzance as a study area.

Descriptions of the landscape, including the south-west of England, started to appear in the sixteenth century and these were often accompanied by woodcuts or copper plate engravings. One of the first of these was a '*Topographical and Historical Description of Cornwall*' (Norden, 1966). A further particularly significant work was '*Survey of Cornwall*' by Richard Carew, which is regarded as one of the finest early topographical books of the British Isles.

One of the most well-known publications relating to the west of England was William Borlase's (1696-1722) '*Natural History of Cornwall*' (Borlase, 1769), which is the publication referenced in section 2.1 with information on the prehistoric landscapes in the study area.

The western end of the Cornwall peninsula has been painted visited by numerous artists over the last two hundred years. They were attracted by the rugged cliff scenery, the brightness of the light and the colours of the sea as well as the day-to-day lives of the villagers and fishermen. Some artists moved to the area living within artist colonies such as at Newlyn whilst others visited on a regular basis.

By the early nineteenth century many great artists were making tours either at the request of wealthy patrons, or for their own commercial interest. Thomas Rowlandson, J. M. W. Turner and many others produced works, some of which formed elaborate publications. Through the nineteenth century increasing numbers of books appeared, first, often illustrated with copper plate or aquatint engravings and, later, steel engravings such as those by W.H. Bartlett, T. Allom and others in '*Devon and Cornwall illustrated*' (Britton & Brayley, 1832).

The Cornish coastline remained a popular venue for artists throughout the latter part of the nineteenth century and early twentieth century. Many of Britain's great painters of coastal scenery visited the region including John Mogford, Samuel Phillips Jackson and George Wolfe. The quality of the reflected light from the sea, the rugged coastal scenery and the coastal fishing communities led to the establishment of large colonies of artists not only at Newlyn but also at St Ives and Lamorna in Cornwall.

Stanhope Alexander Forbes, along with Walter Langley (1852-1922), was a founder of the Newlyn School of artists, located in the fishing village. Forbes has been referred to as the '*Father of the Newlyn School*' and was instrumental in the development of the area as an established artists' School. In 1895 he established the Newlyn Art Gallery and was chairman and trustee. In 1899 he formed the popular Newlyn Art School. Walter Langley has been credited with being the "*earliest 'pioneer' of the Newlyn colony of artists*" and he settled there in 1882 (Hardie, 2009).

A significant number of the artists who settled in Newlyn had previously studied (often together) in the *ateliers* of Paris and were greatly influenced by French *plein-air*. The artists were eager to capture the realities of life for the local inhabitants, but also to "*capture the effect of natural light...inspired by the French plein-air painters*" (Newton, 2005).

The artists who gathered in the town of Newlyn were drawn to it by its ‘other-worldliness’, being as it was so far away geographically and culturally from the large industrial towns that were developing across England. The simple life of the fishermen and women of Cornwall proved inspirational to the visiting artists. They were keen to depict the area in its true form (realism), which avoided sentimentalising the lives of the inhabitants. On a practical note, many artists chose to stay and work in Newlyn due to the inexpensive living costs and readily available models willing to sit for their work. Wives waiting for their husbands to return safely to the village from fishing excursions was a recurrent theme, as were fishermen going about their daily work, for example, Langley’s watercolour *‘Between the Tides’* dating 1901.

The nineteenth century Cornish artist Richard Thomas Pentreath (1806-1869) painted at Mount’s Bay, Penzance, Mousehole, Land’s End, St Ives and Newlyn, before moving to Exmouth in the 1850s. A significant number of other artists were also connected with the Newlyn School, which continued to thrive during the early years of the twentieth century and attracted new artists to the area.

Two brothers – Walter and Henry Tremenheere, were born in Penzance, had naval careers and were both keen artists. Walter had training in drawing in the navy, and later in life often visited his brother Henry who retired to Penzance. Their local knowledge and understanding of the coast can be seen in their depictions of Newlyn.

The turn of the twentieth century and the increased level of tourists visiting coastal locations in the south-west led to a greater demand for watercolour and photographic postcards. Two artists, Henry Wimbush (1858-1943) and Alfred Robert Quinton (1853-1934), were particularly prolific in their production of picture postcards of this area.

#### 4.1.2 Results of Art Scoring

The development of the scoring system for works of art is described in *SARCC Maritime Atlas: Methodology Report* (MAT, forthcoming). Details of each artwork have been entered into the project database, including information on artwork type, medium, subject matter, time period and other parameters, the database was then able to calculate the scores for works of art from the pilot study site. 36 artworks were scored and analysed for the project, the highest scoring art works were:

Art UID	Source Title	Artist	Date	Score medium	Score period	Score style	Score heritage	Score environ	Total Score
333	Old Quay Newlyn	Henry John Williams	1887	Watercolour	1840 - 1880 (Victorian)	Marine/Shipping subjects	Contributes detailed understanding of coast	Detailed appreciation of shoreline position	92
349	Newlyn from Wherrytown 1870s	Henry Martin		Watercolour	1840 - 1880	Topographical/beach & coastal scenery	Supports understanding of coast	Detailed appreciation of shoreline position	88
335	September, at Newlyn, low water	Frederick Mercer	1876	Watercolour	1880-1920	Topographical/beach & coastal scenery	Suggests position of coast	Detailed appreciation of shoreline position	85
340	Newlyn Harbour 1887	Charles H Whitworth	1887	Watercolour	1880-1920	Marine/Shipping subjects	Suggests position of coast	Detailed appreciation of shoreline position	81

Art UID	Source Title	Artist	Date	Score medium	Score period	Score style	Score heritage	Score environ	Total Score
357	Newlyn, near Penzance, Cornwall	Charles George Lewis after Edward William Cooke		Etching	1840 - 1880	Marine/Shipping subjects	Suggests position of coast	Detailed appreciation of shoreline position	81
343	Newlyn	Thomas Cooper Gotch		Watercolour	1880-1920	Marine/Shipping subjects	Suggests position of coast	Detailed appreciation of shoreline position	81
334	Newlyn from Tolcarne	Walter Tremenheere		Litho/fine pencil/watercolour drawings	1770-1840 Early	Topo/beach & coastal - Pre-Raphaelite	Supports understanding of coast	Detailed appreciation of shoreline position	77
350	Penzance from Wherrytown	Henry Martin		Watercolour	1840 - 1880	Topographical/beach & coastal scenery	Suggests position of coast	General view of the beach, cliff, backshore	74
336	Old Tolcarne Bridge, Newlyn	Henry Pendarves Tremenheere	1804	Watercolour - Pre-Raphaelite	1770-1840 Early	Picturesque landscapes	Suggests position of coast	Riverside scene	70
337	Penzance from Newlyn	Thomas Herbert Victor	1910	Watercolour	1880-1920	Topographical/beach & coastal scenery	Suggests position of coast	General coastal view	70
347	Old Paul Hill	Stanhope Alexander Forbes		Oil painting	1880-1920	Picturesque landscapes	Supports understanding of coast	Detailed appreciation of shoreline position	66
342	The Breadwinners / Newlyn Fishwives	Walter Langley		Watercolour	1880-1920	Caricaturist/Genre subjects	Suggests position of coast	General view of the beach, cliff, backshore	66

Table: The highest scoring artworks within the Newlyn Pilot Study Area

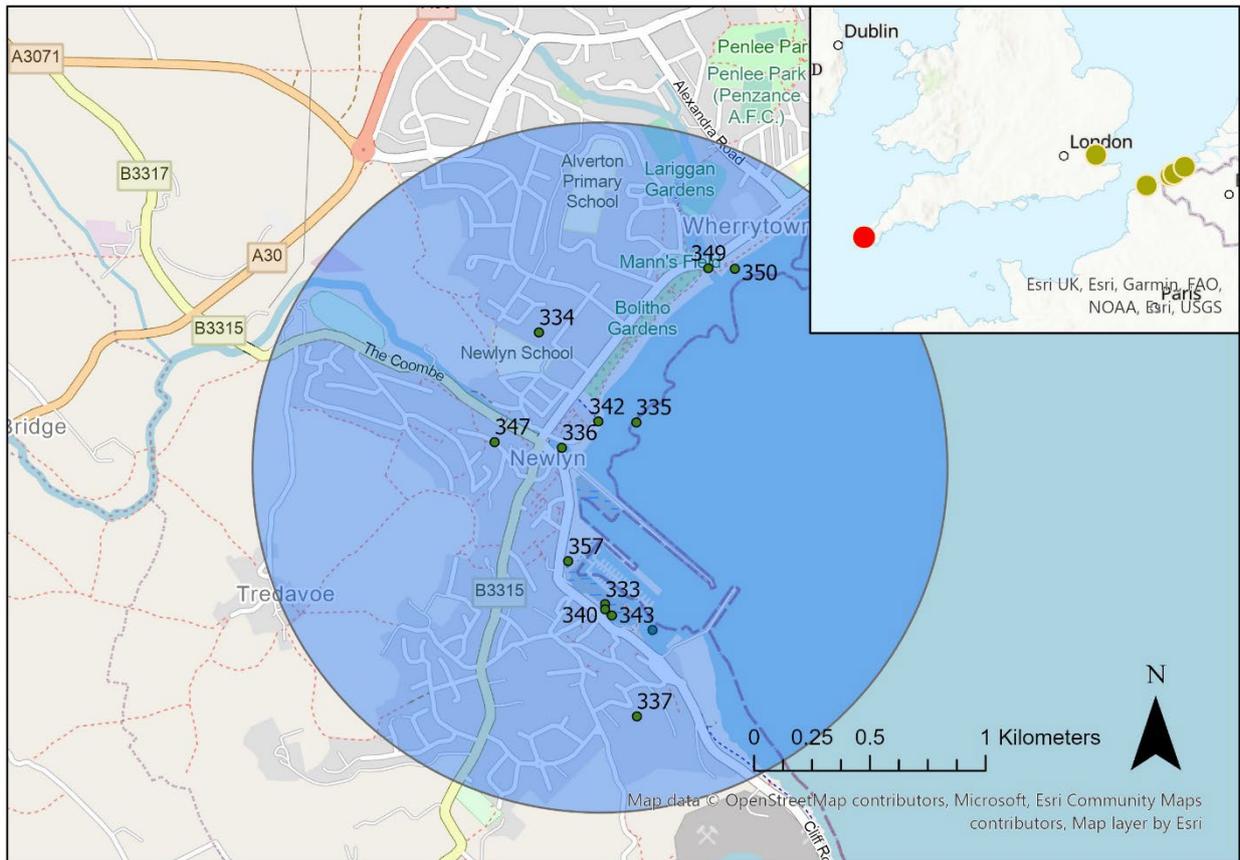


Figure 27: Distribution of the highest scoring art works within the Newlyn Pilot Study Area.

#### 4.1.3 Discussion of Art Scoring Results

The four highest scoring artworks were watercolours produced by Henry Williams, Henry Martin, Frederick Mercer and Charles Whitworth, which each scored 92, 88, 85 and 81 respectively. Also scoring 81 were an etching by Charles George Lewis after Edward William Cooke and another watercolour, this one by Thomas Gotch. Nine of the top twelve scoring artworks are watercolours, with other mediums including etching, oil painting and lithograph. Many of the highest scoring artworks are described further below in the comparative analysis of them with the modern day shoreline.

The Old Harbour and new harbours are popular subjects within these paintings, along with other areas in and around the Newlyn Pilot Study area, including Gwavas Quay, Tolcarne and the foreshore to the east of the Coombe River off Wherry Town. The highlighting of these areas through the scoring system has allowed more detailed analysis of change over time, showing the impact of differing coastal conditions and processes as well as structures and construction along or out from the shoreline.

#### 4.1.4 Comparative Analysis of High Scoring Art Works & Modern Coastal Conditions

Following scoring of 36 artworks a number of examples have been the subject of more detailed analysis involving site visits. Where it was 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 shore and harbour side to note changes that may have taken place over time; inspections were timed to coincide with Low Water. This ensured that thorough comparison could be made between the situation depicted in the artwork and the present-day situation.

#### 4.1.4.1 Newlyn Old Harbour

The view in both directions across Newlyn Old Harbour has always been a popular subject for artists. Many of the paintings capture the same features: the curved harbour wall with ships moored within its shelter and on the slipway, the houses and buildings above, fishing boats, rowing boats and red sailed ships (Mount's Bay Luggers) and fishing boats being unloaded (Figures 28, 29 and 30). Many of the paintings are at low-tide and capture fishing activities on the foreshore.



Figure 28: Old Quay, Newlyn, 1887 Henry John Williams. Image courtesy Penlee House Gallery & Museum, Penzance



Figure 29 September (At Newlyn, Low Water) Frederick Mercer 1876 Image courtesy Penlee House Gallery & Museum, Penzance



Figure 30 (Left): Newlyn near Penzance a lithograph by Charles George Lewis. (Original by Edward William Cooke, undated). Source <http://www.rareoldprints.com/z/20593> Copyright unknown accessed 01/04/2021 November 2020

Figure 31 (Right): The view in November 2020 MAT

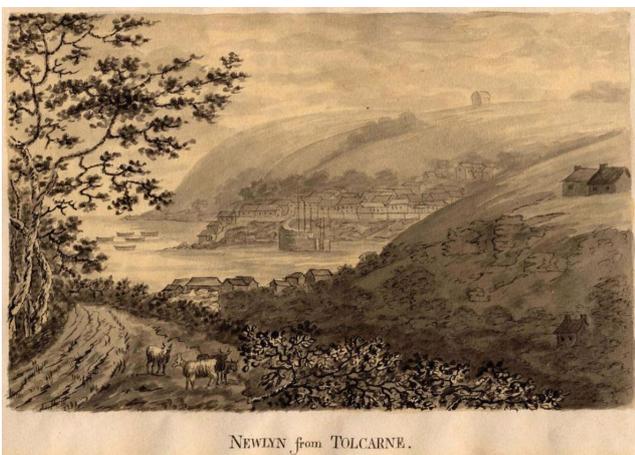


Figure 32 (left) t: Newlyn from Tolcarne Walter Tremenheere undated c1790's. Image courtesy Penlee House Gallery & Museum, Penzance. Figure 33 (right) MAT November 2020.

### Observations on the artworks

The artworks show the large-scale changes to the harbour and town. In the modern photograph, the old, curved harbour wall can still be seen and the buildings adjacent to it appear little changed and many, such as the one circled in red, and those leading down to the water's edge next to the south pier, look likely to be the original buildings captured in the art works. Today the harbour is much busier. Newlyn remains the largest fishing port in the UK, and in addition now has a large visitor population, with both visiting sailors and tourists. New pontoons in the harbour provide mooring for yachts and pleasure boats. Dredging for the new harbour and berths has altered the bed levels and the differences can be seen in the modern photo (Figure 31) compared to the paintings. The rocks that jutted out seaward from behind the old harbour have been removed. Other additions to the harbour, include the (new) Penlee Lifeboat Station 1913, the Ordnance Survey Tidal Observatory 1915, and pubs and restaurants to cater for tourists.

The modern photograph of the harbour from a distance shows (Figure 33) how much the town has developed. Dense 20<sup>th</sup> Century housing is obvious in the foreground together with further development behind the harbour, which is barely distinguishable in the background. This is in stark contrast to the rural scene painted by Walter Tremenheere in the 1790's (Figure 32).

### Where can the original artwork be viewed?

With the exception of Cooke, these paintings can be seen at Penlee House Gallery and Museum in Penzance and on their website <https://www.penleehouse.org.uk/>

#### 4.1.4.2 Newlyn Harbour



Figure 34 (Left) Newlyn Harbour towards Penzance c1912 Alfred Robert Quinton source <https://www.morrabstudio.co.uk/p/28852/Historical-Cornwall---Newlyn-Harbour-1920-Single-Card> Copyright Unknown. Accessed 01/04/2021 . Figure 35 (Right) The view in November 2020 MAT.

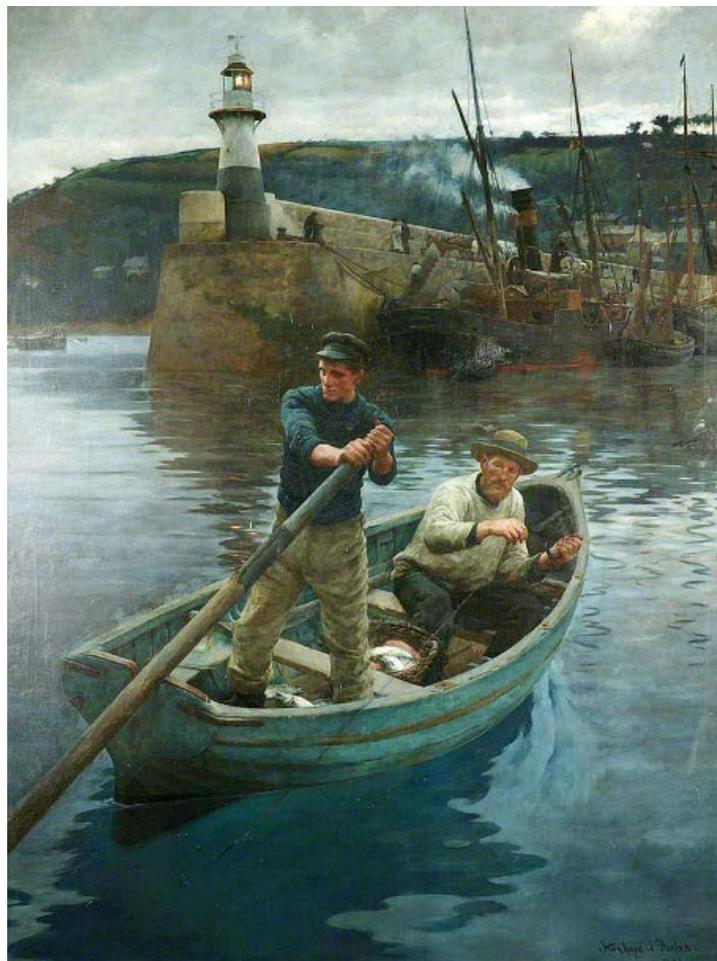


Figure 36 Stanhope Forbes, 1893

<https://commons.wikimedia.org/w/index.php?search=stanhope+Alexander+Forbes+lighthouse&title=Special:MediaSearch&go=Go&type=image> accessed 22/07/2021

#### Observations on the artworks

Quinton's c1912 scene of Newlyn Harbour (Figure 36) shows the South Pier, with both sail and steamboats moored within the wall. The town of Penzance is visible in the background. The current pier was constructed in stages between 1884-1887, an extension of the original, with the lighthouse replaced in 1855, as seen in the painting. The harbour wall is accessible by cart, a contrast to the vehicles in the modern photograph

(Figure 35). Dredging now enables the larger modern fishing vessels to enter the harbour. There appears to have been little change to the buildings between those in Quintons painting (Figure 34), and those visible not (Figure 35) most of which look to be original, with the addition of shellfish storage tanks on the end. The South Pier is also home to the Newlyn Tidal Observatory built between 1913-1915 to establish mean sea level. The observatory continues to provide a facility for scientific tidal measurements, particularly for guiding climate change and coastal management studies. The observatory is grade II listed for both historic and architectural interest, recognising its contribution to tidal studies, the use of local materials in its construction and local contractors in its building.

#### Where can the original artworks be viewed?

The Quinton postcard can be seen at <https://picclick.fr/Artist-Drawn-Postcard-J-Salmon-A-R-Quinton-143953433631.html> and the Stanhope Forbes artwork at Manchester Art Gallery on online at <https://artuk.org/discover/artworks/the-lighthouse-newlyn-cornwall-204995>

#### 4.1.4.3 Gwavas Quay

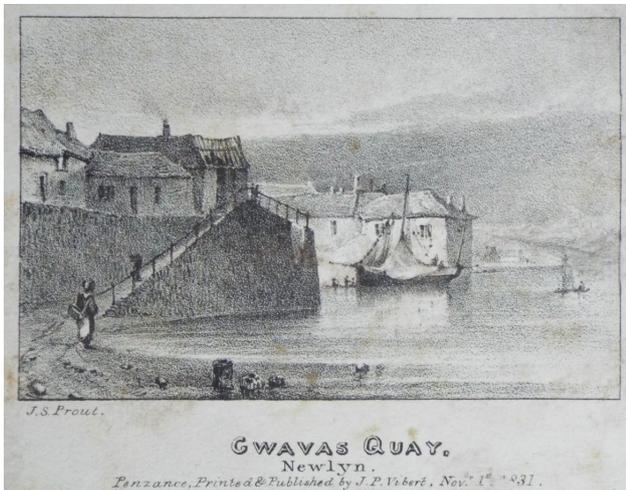


Figure 37 (Left): A lithograph by John Skinner Prout, published in November 1831 source <http://www.rareoldprints.com/p/17265> copyright unknown. This is the view from the foreshore at Newlyn looking along Gwavas Bay. Figure 38 (right) The modern view of the area of Gwavas Quay photographed in November 2020 on the right.



Figure 39 (Left) Henry Martin 'Keel Alley' @public domain c. mid-C19 Source <https://wikioo.org/paintings.php?refarticle=ARAH42&titlepainting=Keel%20Alley,%20Newlyn&artistname=Henry%20Martin>

Figure 40 (Right) The modern view of the area shown in the painting 'Keel Alley', photographed in November 2020 (MAT).



Figure 41 (left) *Between the Tides* 1901 Walter Langley.

(source:[https://commons.wikimedia.org/wiki/Category:Walter\\_Langley#/media/File:Walter\\_Langley\\_-\\_Between\\_The\\_Tides\\_1901.jpg](https://commons.wikimedia.org/wiki/Category:Walter_Langley#/media/File:Walter_Langley_-_Between_The_Tides_1901.jpg) Creative Commons accessed 22/07/2021)

Figure 42 (right) The modern view of the area shown in '*Between the Tides*', photographed in November 2020  
MAT

### Observations on the artworks

At the time of these paintings, until 1908, Newlyn was two separate communities (Street-a-Nowan and Newlyn). The east and west sides were only connected by a beach at low-tide. At high-tide, crossing to the other side required a detour inland or ferry crossing. In Prout's lithograph (Figure 37), the lady on the left looks like she might be waiting for the ferry. The inlet where the ship is headed, is the subject of the painting by Henry Martin (Figure 39). Keel Alley was the 20<sup>th</sup> century name given to the area behind this natural inlet harbour, where the sailing boats are seen entering. Two streets developed here: The Fradgan and Gwavas Quay. Several buildings dating to the 18<sup>th</sup> and 19<sup>th</sup> centuries remain today, as do surviving areas of street cobbles (Figure 40).

At the time of construction of the New Harbour areas along Gwavas Quay were beginning to be in filled to develop the harbour edge here. In 1908 a causeway, 'The Stand', was built to join the two communities. Initially raised up on piers, small tenders were still able to access the harbour. But, later this was formalised into a hard frontage for a traditional road, the area that was Gwavas Quay is filled in and is now a public green space (Figure 40). The old slipway can still be seen leading down in front of the houses, and the old harbour wall can be seen on the left.

'Between the tides' (Figure 41) shows the old slipway on Qwavas Quay, believed to have been built before the 17<sup>th</sup> century, and rebuilt 1772-3. The slipway can still be seen today (Figure 42), though the steps leading down to the quay have been replaced by a tarmacked slope to provide vehicular access.

### Where can the original artwork be viewed?

Henry Martin's "Keel Alley" can be seen at Penlee House Gallery and Museum in Penzance and also on their website <https://www.penleehouse.org.uk/object/pezph-2013-15/>

Walter Langley's "Between the Tides" can be seen at Warrington Art Gallery and online at <https://www.artuk.org/discover/artworks/between-the-tides-104064>

#### 4.1.4.4 Tolcarne Bridge

The Coombe River lies to the east of Newlyn harbour and is now crossed by a number of bridges. The hamlet of Tolcarne is on this river, as is one of the oldest bridge crossings – the old Tolcarne Bridge. The river discharges to the sea immediately adjacent to the modern harbour North Pier and is regularly subject to flooding when high tide and storm conditions coincide. The Newlyn NBS Pilot is located close to the mouth of the River.



Figure 43: Old Tolcarne Bridge, Newlyn Henry Pendarves Tremenheere 1804 Image courtesy Penlee House Gallery & Museum, Penzance

#### Observations on the artwork

Henry Tremenheere's painting (Figure 43) shows a very rural scene, with just a handful of stone and thatch cottages set back from the river. The route of the river can be seen, flowing through the landscape and out to sea, at this time there are few structures directly adjacent to the stream and its course appears to be relatively 'natural'. The modern photograph (Figure 44) shows a very different scene of modern stone houses tightly packed and encroaching on the river, which has been narrowed and enclosed. The striking change of the area around the river has had a direct impact on its rates of flow and its relationship to the shoreline where it exits and has funnelled the river into a relatively narrow channel.

#### Where can the original artwork be viewed?

Henry Tremenheere's painting of Old Tolcarne Bridge can be seen at Penlee House Gallery and Museum in Penzance, and also on their website. It can also be seen online at <https://www.watercolourworld.org/painting/old-tolcarne-bridge-newlyn-tww0023d2>



Figure 44: Old Tolcarne Bridge November 2020 MAT

#### 4.1.4.5 Wherry Town Beach

To the east of the Harbour and the Coombe River is Wherry Town Beach. Simply called Wherry Beach by painters in the 19<sup>th</sup> century, this was a wooded area before the town developed in the last years of the 1800's. The areas was used by small fishing boats which could haul up on the shallow shoreline and there was also various periods of mining that occurred in the area causing development of the buildings behind the beach.



Figure 45 (Left) Penzance from Wherry Town 1870's Henry Martin (Image courtesy Penlee House Gallery & Museum), Penzance. Figure 46 (Right) The same view November 2020 MAT



Figure 47 (left) *The Breadwinners/Newlyn Fishwives* Walter Langley Undated (1852-1922) Wikimedia Commons [https://commons.wikimedia.org/wiki/File:Study\\_for\\_Breadwinners,\\_by\\_Walter\\_Langley.jpg](https://commons.wikimedia.org/wiki/File:Study_for_Breadwinners,_by_Walter_Langley.jpg) Figure 48 (right) *The same view in November 2020, MAT*

### Observations on the artworks

In the first painting, by Henry Martin in 1870 (Figure 45), the town of Penzance is shown in the distance, with two churches and a density of housing. Masts can be seen in Penzance Harbour and sailing ships sail between Penzance and St Michaels Mount. It shows the sandy nature and foreshore slope of Wherry Town Beach.

A scene titled 'Looking towards Penzance from Wherry Beach' from 1898, (not shown here, but scoring highly within the SARCC system (available from Getty Images)) shows fishing boats on the inter-tidal zone at low tide, with men and women folding their nets. A horse and cart wait by the boats. In the middle-distance people are collecting shellfish from the rocky outcrops at low water. The foreshore appears to be a mix of sand and cobble with rock outcrops. In the distance the town of Penzance is clear to see, with a high density of terraced houses. Sailing boats and a steam vessel sail between Battery Rocks and St Michaels Mount.

Today the sloping pebble beach is accessed by a promenade (Figure 46) and is a popular tourist beach. Storms have caused much damage to the coastline here over the years, particularly in 1880, 1883 and on the 7<sup>th</sup> March 1962, when the Ash Wednesday storm destroyed the mile of seafront between Battery Rocks and Tolcarne (which is the area seen in Figure 46). Only one building survived, the Mount's Bay Inn (built 1880's and currently under threat of demolition). A seawall has now been added running along the sea front. Large rocks and shingle have been added higher up the beach, it is no longer the sandy foreshore captured in the paintings, though the same rocky outcrops are still visible at low-tide in the inter-tidal zone.

On Wherry Beach, looking back towards Newlyn Harbour, Walter Langley painted 'The Breadwinners' (Figure 47), Fisherwomen carrying baskets of fish unloaded from the ships that had landed on Wherry Town Beach. The lighthouse on the South Pier can be seen in the background, together with horses and carts and people unloading the fishing boats, with more fishing boats anchored outside the harbour. Today, the scene is much the same (Figure 48), though fishing boats no longer haul up here to unload, instead, they use the harbours at Newlyn and Penzance.

### Where can the original artwork be viewed?

Henry Martin's painting (Figure 45) can be seen at Penlee House Gallery and Museum in Penzance and also on their website <https://www.penleehouse.org.uk/object/pezph-2016-110/>

'The Breadwinners' by Walter Langley (Figure 47) can be seen at Penlee House Gallery and Museum in Penzance, on their website at <https://www.penleehouse.org.uk/object/pezph-1989-83/>

## 4.2 Photographs/ Postcards

Photographs are an invaluable resource to support coastal change studies because they represent true depictions of the landscape; there is not the need to rank them in the same way as artworks (where views may be susceptible to interpretation and variation). For photographs to be used to assess how they can support studies of coastal change the two key issues are the *content* (in terms of what the image tells us) and the *quality of the image*. Because of the dynamic nature of this coastline historic photographs can be a particularly valuable resource with many historic photos containing depictions of the shore and sea front with recognisable heritage features nearby, including buildings, quays and bridges. These can be compared to the modern situation and from this an accurate idea of the rate of erosion since the date of the photograph can be gained.

A total of 75 historic photos were assessed as part of the project, images include those from locations within the pilot area where historic paintings and archaeological sites were also known. The photographs were collected and then scored using the methodology outlined in *SARCC Maritime Atlas: Methodology Report* (MAT, 2022). The study and scoring of historic photographs highlights the potential for historic photos to provide information on coastal change. Sources and archives used included a range of national, regional and locally based resources that are available online.

### 4.2.1 Results of Scoring

This pilot area has a wealth of available historic photographs and postcards many of which depict the aftermath of storms. 75 photographs were entered into the project database, those images which scored 100 and over have been included below within the ‘high scoring’ results. The figure shows the distribution of the images and the table has the detail of their subjects and scores.

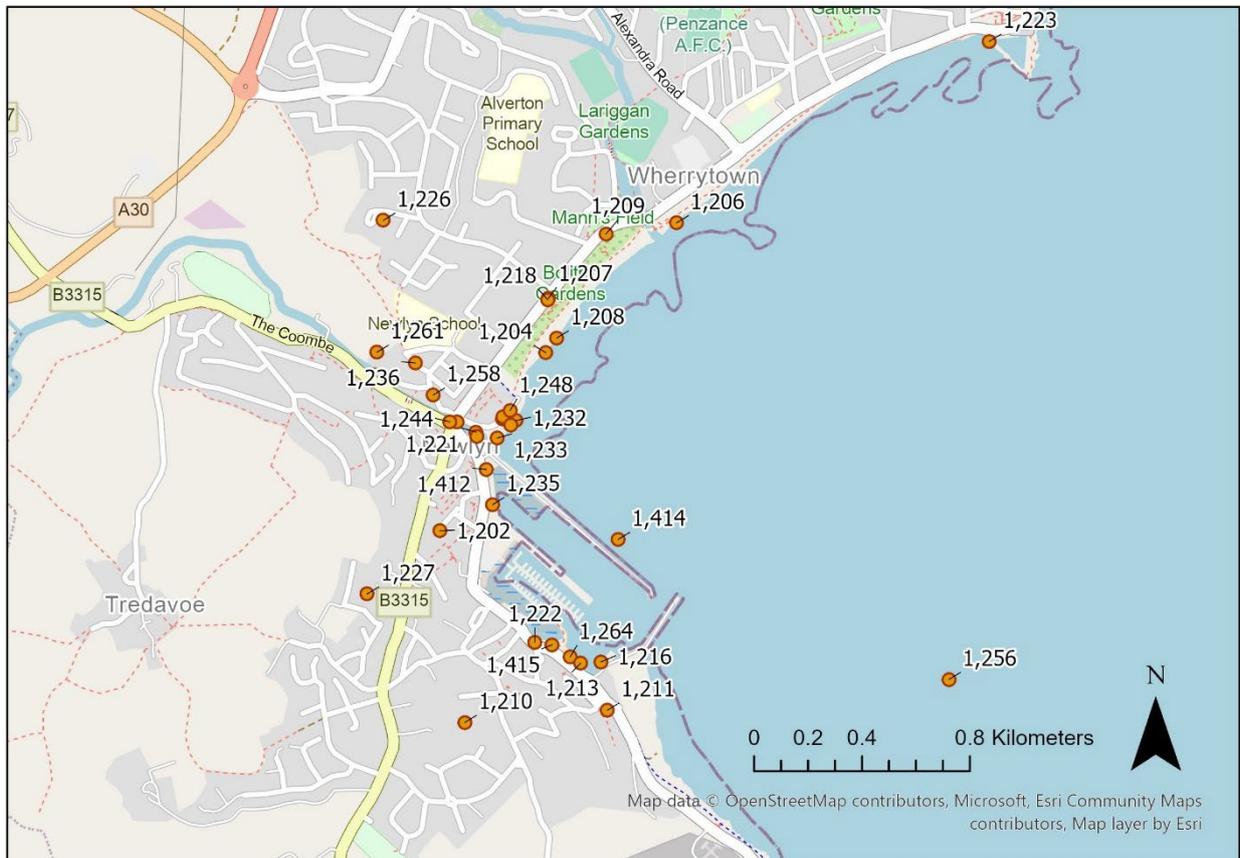


Figure 49: Distribution of high scoring photographs and postcards across the Newlyn study area

Image ID	Title	Year	Purpose	Score Heritage View	Physical Image State	Total Score
1202	Penzance from Newlyn		Tourist	Detailed	Good	100
1204	Penzance: the Front from Newlyn	1940	Tourist	Detailed	Good	100
1206	Wherry Mine 1890's	1890	private	Detailed	Good	100
1207	Tolcarne, Newlyn Rd destroyed by storm damage 1880	1880	private	Detailed	Good	100
1208	Tolcarne, Newlyn, Penzance 1890's	1880	Unknown	Detailed	Good	100
1209	Building the road to Newlyn Town, Penzance 1890's	1890	Private	Detailed	Good	100
1210	Newlyn, Penzance 1893	1893	Private	Detailed	Good	100
1211	Newlyn towards Penzance 1896	1896	Private	Detailed	Good	100
1213	Victorian life in Cornwall Fishwives in Newlyn	1890	Private	Detailed	Good	100
1216	Newlyn Harbour Cornwall	1906	private	Detailed	Good	100
1218	Newlyn to Lariggan the next day	1962	Unknown	Detailed	Good	100
1221	Tolcarne Bridge before 1880	1880	Unknown	Detailed	Good	100
1222	Newlyn Harbour	?	unknown	Detailed	Good	100
1223	1962 storm, looking towards Newlyn	1962	private	Detailed	Good	100
1226	Penzance from Newlyn before Lidden Estate	1890		Detailed	Good	100
1227	Penzance from Newlyn	1946	Tourist	Detailed	Good	100
1230	Crowds on Newlyn Bridge, Tolcarne Mill Wheel	1900	unknown	Detailed	Good	100
1231	Newlyn storm damage. Ash Wednesday 1962. On the side of the Tolcarne Inn	1962	unknown	Detailed	Good	100
1232	Tolcarne Newlyn storm damage 1962. Breach of seawall	1962	unknown	Detailed	Good	100
1233	View at Newlyn	1850	Unknown	Detailed	Good	100
1234	Tolcarne Newlyn	1850	unknown	Detailed	Good	100
1235	Newlyn Fishing Boats	1850	Unknown	Detailed	Good	100
1236	Newlyn from Toll Carn	1850	Unknown	Detailed	Good	100
1244	Tolcarne Mill when John Coulson was the Miller	1880	unknown	Detailed	Good	100
1247	Tolcarne, Newlyn storm damage 1962	1962	unknown	Detailed	Good	100
1248	Tolcarne newlyn storm damage to sea wall 1962	1962	unknown	Detailed	Good	100
1256	Newlyn Harbour and the town 1932	1932	unknown	Detailed	Good	100
1258	The Old Ice Works in 1971	1971	unknown	Detailed	Good	100
1261	Penzance from Tolcarne, Newlyn	1900	Tourist	Detailed	Good	100
1264	Newlyn, Cornwall circa 1890	1890	unknown	Detailed	Good	100
1412	Keel Alley and before the South Pier	0	unknown	Detailed	Good	100
1414	Newlyn harbour from the sea pre 1885 pier	1890	Unknown	Detailed	Good	100
1415	Newlyn Cliff photo see prout engraving	1905	Unknown	Detailed	Good	100
1416	New Harbour Road, Newlyn	1908	Unknown	Detailed	Good	100

#### 4.2.2 Discussion of Scoring Results

All of the high scoring photographs from the Pilot Study area were within the category of 'heritage view'. Most contained features or buildings that can be identified today, or were images across or along the coast showing changes. Some of the oldest photographs available date to the 1850, then there are increasing numbers of photographs available as you go through time.

Just a few examples of historic photographs are considered here to demonstrate their potential for providing detailed information. More historic photographs are included in Section 5 to show how they can be utilised within combined analysis.

Figure 50 provides an interesting view which captures the Study Area before the major construction works of the New Harbour and road way. It shows the area from Gwavas Quay and looking across towards the Old Harbour, you can see how at high water the tide would have cut off the two main areas of the town. Figure 51 is taken from closer to the Old Harbour and dates to after the construction of the New Harbour South Pier. This view is captured in many of the art works and can be directly compared.



Figure 50: (ID 1412) The area of Keel Alley looking towards the Old Harbour, dates to before the New Harbour south pier was constructed (Courtesy of Penlee House Gallery and Museums: Acc.no: PEZPH : 1990.1351)



Figure 51 (ID 1216) Francis Francis Frith & Co, 1906 Newlyn Harbour. Public domain, via Wikimedia Commons [https://commons.wikimedia.org/wiki/File:Newlyn\\_harbour,\\_Cornwall\\_RMG\\_G03163.tiff](https://commons.wikimedia.org/wiki/File:Newlyn_harbour,_Cornwall_RMG_G03163.tiff) accessed 22/07/2021



Figure 52 (ID 1234) Tolcarne, Newlyn dated between 1850-1870 (Copyright Victoria & Albert Museum - Acquired from F. Frith and Company, 1954: <https://collections.vam.ac.uk/item/O216696/tolcarne-newlyn-photograph-francis-frith/> accessed 22/07/2021)

The early photograph of Tolcarne (Figure 52) captures the old bridge crossing and shows how at this period the river had been constrained within walls and buildings had been constructed directly adjacent to the river.

## 5. Combined Application for Analysis of Coastal Change

The above sections have demonstrated the potential of each type of resource – archaeological, palaeoenvironmental, artistic, maps and charts and photographs – to be assessed and analysed to inform on the scale and pace of coastal change. When these resources are utilised together to look at particular areas or features this provides an exceptionally powerful set of data to be able to understand the long-durée of the coastline. There are a number of areas and features within Newlyn which have a direct relationship to the Pilot Area and understanding how the shoreline around it has changed. These are explored further here.

### 5.1 Analysis of Change: Newlyn's Harbour Developments

**Why selected for detailed study:** The creation of a harbour at Newlyn had occurred by at least the 14<sup>th</sup> century, which would have allowed maritime operations increase for larger vessels as new facilities would mean that ships didn't have to beach on the foreshore. The preservation of the Old Harbour within the New Harbour which was constructed in the late 19<sup>th</sup> Century, means the historic structure is preserved alongside original buildings, quays and steps. The harbours have a direct relationship to the expanding town and have also had an impact on the adjacent shoreline – particularly the New Harbour, which involved the construction of two large Harbour Arms. The northern Harbour Arm has a direct relationship to the development of the Coombe River and how the wave energy and climate interact with the feature today with the resultant storm driven flooding. It is this flooding that the SARCC pilot eco reef is seeking to address through nature based solutions.

**Detail from scoring of available resources:**

As significant physical features so closely linked to the development of the town the Newlyn Harbours appear across the range of scored resources. Figure 53 includes a combination of these resources to show changes over time.

- Archaeology – As such key features within the history of Newlyn it is not surprising that two phases of the old harbour (Medieval (ID 3282: score 55) and Post Medieval (ID3292: score 55)) and each of the new harbour arms feature within the high scoring sites table. The North Pier (ID 3543: score 66) and South Pier (ID3542: score 66) significantly changes the form of the coast here, impacting on sediments both within and outside of the harbour.
- Maps/ Charts – using the results of the scoring exercise it was possible to identify those maps and charts with most detail on the form of the features and the coast over time. Examples shown in Figure 53 include a very early chart of 1540 which shows the ‘old harbour’, although this is a stylised rendering, it shows the relationship with the shoreside buildings. A building in the lower right of the image is slightly separate from the rest and is likely to represent a building at the mouth of the Tolcarne stream. The two Ordnance Survey maps shown from 1887 and 1908 show the area with the old harbour, prior to the construction of the New Harbour and then the first detailed map with the new harbour having been completed. These maps also show the sequence and progression of shoreside changes and building, with a new road built out into the area within the New harbour and infilling of the older Gwavas Quay.
- Art – as outlined in Section 4.1 there are many available art works showing the harbours, particularly the old harbour. These provide detailed perspectives of features which add a different dimension to the maps and charts with data on the vertical dimensions, construction materials and the nature and form of the foreshore. In Figure 53 the painting by Henry John Williams has been selected as it was the highest scoring artwork in the whole study area (Score: 92) and can be directly compared with the historic photograph from around 1900.
- Photographs – as with the art works, the Newlyn Harbours have been very frequently captured within photographs. The photograph in Figure 53 (top right) provides an interesting view which captures the Study Area and old harbour before the major construction works of the New Harbour and road way (ID 1412, Score: 100). It looks across towards the Old Harbour, you can see how at high water the tide would have cut off the two main areas of the town. This example has been selected as it shows how direct comparison with works of art can provide different and additional data on coastal changes.

**How the combined resources inform on coastal change:**

The application of the various scoring systems has identified those resources with most potential to provide information on the scale and pace of coastal changes in relation to the area of the harbours. While taking one type of evidence in isolation, such as the progression of maps and charts can provide a particular perspective in two dimensions, the use and comparison of the art works and historic photographs gives much additional information.

Using the resources in combination and comparing them to the modern situation shows the progression of changes with the building of the old harbour, growth of the town and buildings along the waters edge. The old harbour enclosed a relatively small area and had little impact on the adjacent foreshore setting which has a range of rock outcrops. The constant presence of a number of the historic buildings directly adjacent to the harbour make them excellent markers for helping measure further changes over time.

With the building of the large new harbour there were changes to the morphology within the harbour with dredging and there has been a gradual progression of the shore side outwards into the harbour with the building of a road, new slipways and buildings. The scale of the new harbour arms has a greater impact on the adjacent areas of foreshore outside of the structures with changes due to scour, and wave energy.

## Newlyn's Harbour Developments



Painting (left): Old Quay, Newlyn, 1887 Henry John Williams. Image courtesy Penlee House Gallery & Museum, Penzance



Photo (left): Extract from Historic Photo, likely 1900 (Penlee House Gallery & Museum, Penzance)



Chart (left): Newlyn and old Harbour, 1540 Chart of Mounts Bay (The British Library, [Chart of Mount's Bay (Cornwall) Cotton MS Augustus I i 34 : 2nd quarter of the 16th century] <https://www.bl.uk/collection-items/mounts-bay-cornwall>) accessed 19/07/2021. Public domain)



Map (above): Ordnance Survey map of 1887 (Reproduced with the permission of the National Library of Scotland)



Map (right): Ordnance Survey map of 1908 (Reproduced with the permission of the National Library of Scotland)



Photo (left): Looking along the southern arm of the modern Harbour (MAT, 2020)

Figure 53: Combined resources used to understand changes to Newlyn Harbour and the associated coast and harbour frontage.

## 5.2 Analysis of Change: Gwavas Quay

**Why selected for detailed study:** Gwavas Quay shows the relationship of the harbour edge and shoreline over time and demonstrates considerable change. The Quay was once directly on the waterfront, but now lies a distance back from the harbour front and has been filled in. Until 1908, Newlyn was two separate communities (Street-a-Nowan and Newlyn). These areas were only connected by walking along the beach at low-tide. At high-tide, to cross to the other side required a detour inland or a ferry crossing. Gwavas Quay was the landing place for Street-a-Nowan, lying to the east of the old harbour.

### Detail from scoring of available resources:

Gwavas Quay was an important feature for those living in Street-a-Nowan, providing access for boats and ships at high tide. It appears across the range of scored resources. Figure 54 includes a combination of these resources to show change over time.

- Archaeology – Gwavas Quay appears in the data as post-Medieval Quay. The description mentions the granite wall, some of which is now below an ice works building, and the rough cobbled surface which is still visible.
- Maps/ Charts – as a relatively discrete feature along the shoreline forming part of the developing town of Newlyn, it is shown best on the Ordnance Survey maps, which scored highly within the maps and charts system. Examples shown in Figure 54 provide detailed two-dimensional records of the sequence of change along this area of frontage, showing the foreshore track at low tide and details of the quay and slipway prior to the development of the road, and by the 1937 map the quay is no longer on the frontage.
- Art – as outlined in Section 4.1 there are many available art works showing the harbours, particularly the old harbour and also Gwavas Quay. These provide detailed perspectives of features which add a different dimension to the maps and charts with data on the vertical dimensions, construction materials and the nature and form of the foreshore. In Figure 54 there are two early depictions of the Quay area, one by Prout (top left), where a lady on the foreshore may be waiting for the ferry. The inlet where the ship would be heading (Gwavas Quay) is the subject of the painting by Henry Martin (top centre) is called 'Keel Alley', which was the 20th century name given to the area behind this natural inlet harbour, where the sailing boats are seen entering.
- Photographs – Gwavas Quay has been very frequently captured within photographs. The photograph in Figure 54 (centre right) captures the area of Keel Alley and Gwavas Quay before the road or new harbour were constructed. It provides information on the human use of the area through the individuals pictured and the number of boats on the foreshore, the small tenders high on the foreshore will mark an area above the usual high-water mark providing high resolution data to compare to mapped extents of tides.

### How the combined resources inform on coastal change:

Until the 20<sup>th</sup> century travel between Street-a-Nowan and Newlyn was possible on foot at low tide along the foreshore, to reach between the communities at other times there was either a detour in land or a ferry could be used. At the time of construction of the New Harbour areas along Gwavas Quay were beginning to be filled in to develop the harbour edge here. In 1908 a causeway, 'The Stand', was built to join the two communities. Initially this was raised up on piers, and small boats were still able to access the harbour from Gwavas Quay. However, later the area was formalised into a hard frontage for a traditional road and the area that was Gwavas Quay was filled in, it is now a public green space (Figure 54 (lower right)).

Using the resources in combination and comparing them to the modern situation shows the detailed progression of change at the Quay. Paintings and photographs give detail of the structures in relation to the height of the tides, the form of the foreshore and human use of the area prior to significant changes brought about by the construction of the new harbour. Added to the detailed mapping information can help us understand the progression of the harbour side outwards, resulting in the Quay becoming redundant as a maritime feature, but instead it is now a public amenity asset.

## Gwavas Quay

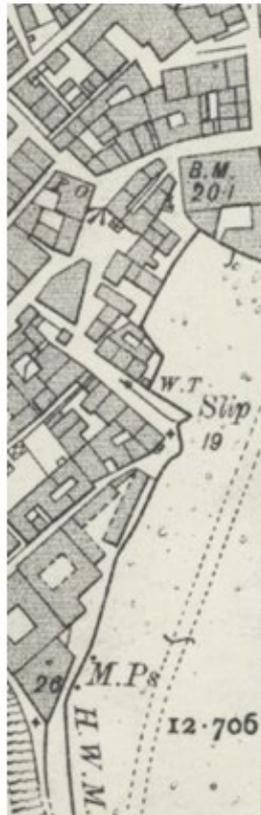


Lithograph (left) John Skinner Prout, published in November 1831 (copyright unknown). Looking from area of old Harbour towards Gwavas Quay.

Painting: (below) Henry Martin 'Keel Alley' public domain c. mid-C19 Source



Photograph (below): The area of Keel Alley, dates to before the New Harbour south pier was constructed (Courtesy of Penlee House Gallery and Museums: Acc.no: PEZPH : 1990.1351)



Maps (left to right): Extracts of Ordnance Survey maps of 1878, 1908, 1937 (Reproduced with the permission of the National Library of Scotland)

Below: Area of Quay now filled in to form a park (MAT 2020)



Figure 54: Combined resources used to understand changes to the area of Gwavas Quay.

### 5.3 Analysis of Change: Coombe River and Tolcarne Bridges

**Why selected for detailed study:** The area of the Coombe River and its associated bridges has been reviewed in detail due to its very direct relevance to the SARCC pilot eco-reef and its installation which is attempting to reduce the amount of storm driven flooding that particularly impacts the river and adjacent areas. The continued development of buildings and features along the river have changed its shape and relationship with the foreshore significantly over time.

**Detail from scoring of available resources:**

The Coombe River once separated the areas of Street-a-nowan and Tolcarne, a bridge had been constructed across the river from at least the Medieval period, if not earlier. The bridges and a range of buildings and features adjacent to the River appears across the range of scored resources. Figure 55 includes a combination of these resources to show change over time.

- Archaeology – two of the bridges over the Coombe River feature within the highest scoring sites – the ‘old bridge’ (ID 3540: score High 88) and the ‘New Road’ bridge (ID 3541: score High 88). The old bridge in particular is exceptionally useful for recording changes to the river side and form of the river, this feature appears in several pictorial resources.
- Maps/ Charts – The two Ordnance Survey maps in Figure 55 show the development of the area around the river and its relationship with the foreshore and harbour. In 1878 there are two bridges over the river and the rivers path across the foreshore is unconstrained, by the time of the 1908 map the new harbour North Pier had been constructed extending directly from the point that the river reaches the foreshore. The path of the river across the foreshore has changed shape from the previous map and appears narrower.
- Art – an important early art work from 1804 by Henry Pendarves Tremeneere (Id 336: score 70) gives important information on how the river looked prior to the build up of structures along its banks. This shows an unconstrained river with a simple bridge crossing.
- Photographs – A number of historic photographs shows the area of Tolcarne, the one in Figure 55 (top right) dates to between 1850-1890 and shows that by this time the river has been constrained between a building on one side and a stone wall on the other. The old Tolcarne bridge is still visible. The view can be directly compared to the painting from 1804 and appears to show comparable buildings that are set back from the stream, but newer ones have been constructed adjacent to the stream.

**How the combined resources inform on coastal change:**

We are able to build a detailed picture of the development of the area around the Coombe River using the combined resources. Over time the river has become increasingly constrained from the relatively open shallow valley river system, to one which is now narrow and tightly bounded on either side. This narrowing will have speeded the waterflow within the river, increasing the associated energy. The position where the river exits onto the foreshore has been further changed with the construction of the new harbour North Pier with the river channel across the foreshore appearing to have narrowed. The North Pier construction has also changed the associated wave energy impacting the entrance to the river and at high water with storm driven waves causes flooding within this narrowed system. The installation of the SARCC pilot eco reef adjacent to the harbour arm and downstream of the Coombe Rivers exit aims to reduce the impact of storm driven wave conditions.

## Coombe River and the Tolcarne Bridges



Painting (left): Old Tolcarne Bridge (1804) (By Henry Pendarves Tremeneere - Image courtesy Penlee House Gallery & Museum, Penzance)



Historic Photograph (right): Tolcarne, Newlyn (1850-1870) (Copyright Victoria & Albert Museum - Acquired from F. Frith and Company, 1954: <https://collections.vam.ac.uk/item/O216696/tolcarne-newlyn-photograph-francis-frith/>)



Map (left): Ordnance Survey map of 1878 (Reproduced with the permission of the National Library of Scotland)



Map (right): Ordnance Survey map of 1908 (Reproduced with the permission of the National Library of Scotland)



Modern Photograph (left): Old Tolcarne Bridge with New Bridge visible behind (MAT, 2020),

Figure 55: Combined resources used to understand changes to the area of the Coombe River and Tolcarne.

## 5.4 Analysis of Change: Frontage to the East of Tolcarne

**Why selected for detailed study:** This area which lies to the east of the Coombe River and Tolcarne, the eastern part of this frontage is known as Wherry Town Beach. In contrast to the areas directly within or adjacent to the harbours, this area is a more open frontage with less development. The area will be impacted by the SARCC pilot eco reef which will work to reduce the wave energy, particularly to the western end. This frontage has been significantly impacted by storms in the past which have undermined and removed parts of the revetment which forms the esplanade in this area.

### Detail from scoring of available resources:

- Archaeology and palaeoenvironmental - There are a number of important site types and deposits in this area which have scored highly for informing on changes. These include a number of historic sea defences, including Post Medieval sea defences which include a late 19<sup>th</sup> Century sea wall (ID 3301), and a further entry which is recorded as containing early Medieval peat deposits and post medieval sea defences (ID 3305: score 88). These features clearly show a history of trying to defend this area of the coast, some of which are now buried below later constructions. The mention of the early Medieval peat deposit indicates the high potential of this area for preserving evidence which gives huge amounts of data of past sea levels and changing environmental conditions. Slightly further to the east is the highest scoring site of 'Wherry Town Prehistoric submarine forest (ID 3313: Score 100). Elements of the deposit have been radio carbon dated to the Bronze Age. Evidence from pollen analysis provides huge amounts of data on the flora and fauna, with alder, oak, hazel and birch all present. Studies of these deposits and those across Mounts Bay have demonstrated progressive periods of sea level rise which have caused the build up of peat deposits within what was once a wooded area, where the Coombe River ran through a valley on route to the sea which was at least a kilometre further out than the present shoreline.
- Maps/ Charts – The three Ordnance Survey maps in Figure 56 show the development of the frontage. Before the new harbour construction when the coastal road hugged the shoreline, then through later periods following the installation of the harbour when the road was moved backwards into fields, with the area between the road and the frontage developing into amenity gardens. The potential impact of the harbour arm construction on foreshore sediments is shown as the foreshore has been lowered between the 1878 and 1908 maps which can be seen by comparing the sediment positions to the hard rock features.
- Art – there are a number of available art works for this area. In Figure 56 a painting looking along the frontage from the 1870s is included, this is by Henry Martin (ID 350: score 74). This shows waves in stormy conditions. Other art works include detail of the use of the area by fishing boats which hauled onto the shore here.
- Historic photographs – as a popular tourist area there are a range of photographs of the frontage, there are also many examples of how storm damage has impacted this frontage on multiple occasions over the years.

### How the combined resources inform on coastal change:

Evidence from archaeological and paleoenvironmental resources show how this area has been subject to large scale changes with particular time-depth revealed by the peat deposits and associated environmental evidence. This gives high resolution data on the long-durée for this area of the coastline.

For at least the past two hundred years there is evidence of sea defences which have been installed to tackle the on-going threat from storms here. Other large scale changes likely in response to coastal threat are shown through the moving of the coast road back from the frontage. While the enduring popularity of the coast for tourism can be seen in the development of a promenade and gardens.

## Frontage to the East of Tolcarne (Wherry Town Beach)



Maps (left to right): Extracts of Ordnance Survey maps of 1878, 1908, 1937 (Reproduced with the permission of the National Library of Scotland)



Painting: Penzance from Wherry Town 1870's Henry Martin (Image courtesy Penlee House Gallery & Museum),

Photo (right): Looking across the modern foreshore (MAT, 2020)



Figure 56: Combined resources used to understand changes to the frontage to the East of Tolcarne (Wherry Town Beach).

## 6. Conclusions

The detail, scope and variety of available sources for the Newlyn Pilot Study has fully demonstrated the potential of the SARCC scoring approach that has been applied to identify those resources of particular importance for understanding the long-durée of the coast.

Evidence from archaeological and palaeoenvironmental records provide evidence from prehistoric periods through to the Second World War. Evidence from the archaeological and palaeoenvironmental studies of peat deposits and associated submerged landscapes can reveal past environmental changes and human responses to this, which in turn can be compared with the events being witnessed today and improve our understanding of how this coastline evolved. Through a better understanding of how the wider Mounts Bay, and at a closer scale the Newlyn to Penzance frontage became what it is today coastal managers will be better placed in planning for the future.

Combining the archaeological and palaeoenvironmental data with artistic resources, including historic maps, charts, photographs and artworks will allow us to understand change from prehistory up to the present day. Artistic resources have been valuable tools in understanding the nature and changes to the harbour structures and adjacent features, the Coombe River and the Wherry Town frontage.

The artwork study and scoring has demonstrated the value of examining a sequence of artworks over time by different artists in terms of providing a record of long-term coastal change. They allow detail and accuracy to be compared across artists and artworks to improve confidence in the reliability of the depictions in addition to the value of the information they impart. The presence of the Newlyn artistic school within the study area has greatly increased the amount of artwork available for this study.

The combination of the various available sources of data have provided detail on the form and scale of change over time – particularly with the installation of the New Harbour, change at Gwavas Quay and the narrowing of the Coombe River, while others show that some elements remain quite unchanged – the Old Harbour and adjacent buildings and slipways, and the general topography of Wherry Town Beach. This information is of importance to the coastal scientist. Cornwall has a very rich art history, being one of the most painted coastlines in Britain – there is further opportunity to apply the SARCC approach in other areas of the Cornish coastal frontage.

In many locations around the UK coastline detailed monitoring has taken place for less than twenty years. This pilot study helps explain the rate of change over past centuries as a result of sea level changes, human construction and the relationship of this with apparent periods of increased storm frequency. These data can supplement existing and future monitoring of trends and can support predictions for the future.

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