# Defence since the application of gunpowder: 1380-2020

*Victor Smith*

With contributions from Luke Barber, David Bird, Martin Brown, David Burridge, Chris Butler, Jonathan Coad, Wayne Cocroft, Ben Croxford, Paul Cuming, Ben Found, John Goodwin, Peter Kendall, John Kenyon, Andrew Saunders and John Wells

## Contents

# Resource Assessment

## *Introduction*

### *Geographical factors and influences*

Historically, much of Britain's coast has been at risk from raid or invasion. This is especially true of the South-East, whose closeness to the Continent via the short sea crossing, so favouring communication and trade, also made it vulnerable to a landing, rendering the broader land mass open to conquest. The region therefore figured prominently in Defence of the Realm. At its northern extremity the Thames trading route penetrates inland to London and the English heartland and was, therefore, a tempting target for an invader. Nearby the Medway estuary was also vulnerable. From there to Thanet and then west along the Channel Coast to Chichester Harbour were a number of beaches suitable, in varying degrees, for the landing of troops as well as ports and inlets where an invader might find shelter and unload supplies. Dover was an important port for an invader to seize (Coad 1995: 12).

The discontinuous rampart of chalk cliffs and areas of marshland along the coast were places of difficulty or less ease for an invader and of advantage for a defender. Some ports were useful to the defenders for the basing of naval squadrons. Naval bases with building facilities and river anchorages were established in the 16th and 17th centuries in the Medway at Chatham and Sheerness (Saunders 1989: 55 and 92). These were important for defence against an enemy approaching across the North Sea and to protect the eastern end of the English Channel. From the 16th century there was government naval shipbuilding at Deptford and Woolwich on Thameside, added to which was production from private yards in the Thames and Medway. The Thames was also used as a base for naval operations. There were sea anchorages at the Nore, The Downs and Dungeness. Dover was important for cross-channel traffic and it was a haven in the narrow seas. Its initially modest harbour was enlarged in stages through the 16th century and, incrementally, over successive centuries. Eventually, with Ramsgate, it became designated as a Naval Harbour of Refuge. To the west was the Portsmouth naval base which, with its more distant counterpart at Plymouth, provided naval forces for Channel defence (Saunders 1997: 29 et seq).

In his confident claim of 1803, Napoleon Bonaparte asserted that 'The Channel is but a ditch and anyone may cross it who has the courage.' As a national border, the coast's security was, of course, an enduring concern. The availability of the fleet as a first line of protection, backed by defences on land, underpinned the strategy for Defence of the Realm. Indeed, the main concentration of defences in the region focussed on the protection of naval bases and harbours, supplemented - mainly in time of war - with the provision of measures for the denial of possible landing beaches. As commented by Colonel Maurice-Jones, the coastal defences kept goal behind the Royal Navy (Maurice-Jones 1959: 278). But from the 20th century and the appearance of the new threat of attack from the air there was also a need for systems of air defence.

The coast has not remained constant: changing sea levels, erosion and silting waterways required adjustments to invaders' and defenders' strategies, influencing where defences were built. In the hinterland, rivers, valleys, roads and hills, suggested invasion routes and holding positions for a defender. The distinctive Downs cross the

region from east to west. The North Downs, in particular, were well situated for defence, especially where close to London, whose capture would have been an invader's primary objective (Smith 2001: 7).

Defences tell a story of thrust and counter-thrust, with new measures needed to respond to innovations in attack. At sea over the centuries there was the challenge of keeping pace with steady and then rapid advances in the design and propulsion of warships from sail to engine-only power, the use of metal and armour plate rather than wood in construction as well as leapfrogging improvements in the nature and power of artillery. On land, the introduction of the latter rendered fortifications more vulnerable to attack, forcing a rethink of design, and their gradual reduction in height from lofty and visible structures to attempted near invisibility by the end of the 19th century and the use of new approaches to construction. Many fortifications displayed Continental planning influences, which were greater before the 19th century, after which British innovation in design became more assertive. Fortifications were, however, one element of the broader defensive interaction of the field army, the fleet, and later the air force. Transport was an all-important dimension for field forces, including use of roads, water routes and, later, the railways, a subject needing to be adequately explored. Gaining pace from the early 19th century was a spread of facilities for the military training of home forces and for those to serve overseas. These included training grounds and firing ranges for the army, the militia and the volunteers. Among them were annual training camps at Coxheath and elsewhere. But there were many other training areas, for example in north-west Surrey and at Chatham, Shorncliffe, Hythe and Lydd (Douet 1998: 129). During the two World Wars areas for training proliferated on a huge scale.

There are a number of commendable publications on military remains covering the region (Brown 2003; Burridge 1997; Butler 2007; Butler 2008; Coad 1995; Coad and Lewis 1982; Firth 1921; Goodwin 1985; Goodwin 1994; Holden 2017 and 2018; Longstaff-Tyrell 1999; Longstaff-Tyrell 2000; Longstaff-Tyrell 2002; Mace 1996; Mace 1997; Rootes 1980; Saunders 1989; Saunders 1997; Saunders and Smith 2001; Smith 2001; Smith 2004; 2016; Woodburn 1999). Work undertaken as part of the Defence of Britain Project and English Heritage's Monument Protection Programme (Lake 2000) is being published into national synthetic works on certain types of site, which often give good coverage to the South-East, as well as the appreciation of how these sites worked in the landscape and in relation to each other (Dobinson 1996a-h; Dobinson 2000; Dobinson 2001; Foot 2006a; Foot 2006b; Lowry 1996). Such cumulative lists of sites need to be studied in a wide framework, to look at themes such as the response of defence to the development of new technologies/weapon systems (Palmer 2004).

### *The meaning of the region's defences*

The defences symbolised England's determination to safeguard her freedom against foreign aggression. Yet they were more than that. In an age when Britain and her Continental neighbours settled their differences by force of arms, they were protection against militant reaction from states with which the nation was engaged in political and economic competition, sometimes with the exacerbation of religious differences. The economic dimension began particularly with the 17$^{th}$ century mercantile wars with the Dutch (Saunders 1989: 83). Competition moved on to the acquisition of overseas colonies, becoming part of an imperial agenda, with national pride to consider. A state

such as Britain which asserted its aspirations at the expense of others, needed to be strong against rivals. The region's fortifications and naval bases are therefore emblems of all these things. Understandably, the greatest emphasis on measures for defence on land took place during war and against imminent threats and the years of peace could be ones of neglect. But, at times, notably from the mid-19th century, defences resulted from planning to achieve a deterrent balance against a perceived future rival.

In the late-medieval period there was, in varying degrees, raiding by pirates and privateers. Private enterprise ventures and semi-private state-sponsored seizing of ships in ports and offshore reinforced the need for defences. In addition to those provided by the state, some originated from the initiative and payment of local communities (Goodwin 1985: 3).

At times, the conception of the defences reflected the strength and weakness of kings and governments, changing relationships of the Crown with the aristocracy, municipalities and communities as well as evolving attitudes of society to the military. There was a gradual shift to Crown control. Defences also manifested emerging national, political and economic policies and the inter-relationships between military, naval and, later, air defence interests, forming a triad of defence.

Cross-fertilisation of military and civilian technology was part of the country's industrial progress. The national economy benefited from the creation of war industries, for example gunpowder manufacturing centred on Faversham and Chilworth, with explosive manufacturing elsewhere. Utilisation of forests fed a timber industry for the building of warships and there was a Wealden iron industry. There were government ordnance factories and proof grounds at Woolwich and Plumstead. From the 19th century private companies had a steadily significant place in what later came to be labelled the military-industrial complex. Local economies were stimulated by the presence of garrisons and of naval bases, with social consequences when, as at Chatham, Sheerness and Dover, civilian townships grew around them, so influencing urban development. Victualling of the navy and of the military and supply of building materials for forts and barracks will have affected local agriculture and industry, meriting exploration. Soldiers' barracks were initially mostly part of fortifications but, matching the evolution of the standing army, they began to appear in towns and elsewhere from which, when needed, troops could be withdrawn for national defence or for campaigning abroad. They also came to reflect a need to have at the disposal of the Crown and the government a deterrent force against the perceived possibility of a rebellion at home. Finally, fortifications and barracks of any size were also communities of people and the gradual improvement of the living conditions for troops and, where present, of their families (Douet 1998) is another topic deserving of greater study.

Where study has focussed on individual fortifications, defensive systems and weapons, it is the foregoing contextual dimensions which also demand exploration to understand defence more holistically, and to show how security of the homeland and warfare moved from being a minority activity to the 20th century's total war, when the whole of the population was, in various ways, affected. From the mid-19th century war and defence also claimed their place in popular, and often campaigning, literature and later in film, making them ever more issues of public exposure. Finally, it should not be

forgotten that fortifications and other defences influenced the appearance of landscapes, by adapting, modifying or preserving them by retaining fields of fire.

### *The defence heritage resource*

The region's military heritage offers a wealth of sites, demonstrating their place in the Defence of the Realm and sometimes a role in security of the empire. Sites may be visually prominent; others less obvious or underground. The potential for archaeological discovery to learn more is considerable. Finds reported under the Portable Antiquities Scheme have also provided valuable insights. As a genre defence sites offer an important heritage tourism and educational resource. A number have been developed for that purpose through restoration and interpretation. The take up of Kent County Council's earlier *Walking the Walls* and *Front-Line Kent* has demonstrated a public interest. A knowledge and appreciation of our military past and, within that of our historic fortifications, is part of a sense of national identity. At an international level the Historic Fortifications Network and the Crossing the Lines initiatives have shown that by comparing British and Continental defensive architecture, strategic approaches and technology, positive connections and common frames of cultural reference can be created. This promotes an understanding that historic defences are a shared European heritage asset.

## *The beginning of the Age of Gunpowder*

### *Gunports in castles and town walls*

The discovery of gunpowder is outside the scope of this Assessment but from the later 14th century, the influence of firearms on defence is clear in the surviving structures, particularly in Kent's and Sussex's coastal areas: for example in the key-hole and circular gunports at Bodiam, Cooling, Saltwood, and Dover castles as well as in Canterbury's Westgate and town walls, all of which otherwise manifest building traditions of the medieval period, with the use of high stone walls. Known from documentary and pictorial evidence, a royal castle on an innovative concentric plan was built at Queenborough and was provided with firearms (Saunders 1989: 20). Nothing of it remains above ground, its only trace being a low mound (Saunders 1989: 20). In the early 15th century, gun loops were provided at Herstmonceux and Hever Castles, visible at both (Saunders 1989: 15-33). Gun positions were also built to defend Rye and Sandwich, the latter having possible traces of an artillery bulwark (Smith 2001: 15). Shurland Hall on Sheppey, rebuilt in the early 16th century, has gunports (Guy 1980: 213-4). Gunports have been subject to historical critiques of their design and fields of fire (Kenyon 1977). But guns were not dependent on specially designed gunports. They could be fired from any suitable opening in a fortification or outside.

### *The role of firearms in fortifications as part of the strategy of defence*

The significance to be attached to the provision for firearms and their role in the defence of the realm in the age of the castle needs to continue to be considered. Wherever firearms first appeared, they can have been little more than supplements to the traditional weapons, such as bows, cross-bows, torsion engines, lances and swords. There is an unresolved debate about the extent to which gunports were more

a form of martial display at some castles (Coulson 1993: 3-15). However, moves to firearms in fortifications were, for the most part, in areas vulnerable and subject to continental raid or invasion, not least in the South-East of England (Saunders 1989: 19). Moreover, this occurred during the Hundred Years War with France (1337-1453), when enemy coastal descents were an uncomfortable reality, being experienced at Gravesend, Sandwich, Winchelsea and elsewhere (Smith 2001: 14; Turner 1971). Within this consideration the port of Dover and the important node of road communication at Canterbury were strategically necessary to defend. The Cinque Port towns of Sandwich and Rye were also important commercial and national assets, requiring protection on their own account (Saunders 1989: 19). The addition of guns to these places was a rational enhancement for the protection of assets both local and national in value. A strategic value may be assigned to the castle next to the planted royal town at Queenborough (Allen Brown 1976: 134) but the expectations for it need to be better understood. Time Team's trial excavations provided important insights but were limited in scope. Shurland Hall has been the subject of archaeological investigation (Kendall 2011, pers comm).

Rochester's town walls controlled access to and from the bridge of the strategic lower Medway crossing, and were suitable for defence by firearms. Dover Castle was given firearms, (Coad 1995: 12) and the walls of the port below it might have been similarly protected. As in all periods, while local defence of key strategic assets was crucial, what mattered in the event of a landing was the availability of a strong home defence army in the field to defeat the forces of an invader.

To warn of an impending attack from the sea, a network of fire beacons was established along and behind the south coast of England. These were to be lit by an observer when an enemy was spotted, so that defensive forces could be mobilised. At sea and in estuaries there were pinnaces and other vessels to warn of an enemy approach.

## *The new age of long range artillery defence*

### *The decline of the castle and walled town*

Castles as defences gradually declined. Firstly, as badges of feudal government, their military function faded as that institution diminished and, as from early in the 15th century, centralised royal government strengthened (Allen Brown 1976: 128 et seq). Increasingly, responsibility for defences fell upon the Crown and ultimately upon Parliament, but some towns felt compelled to maintain and arm defences, perhaps where the Crown was reluctant to pay (Goodwin 1985: 3). Secondly, and as already noted, high walls for defence were becoming vulnerable to more powerful gunpowder artillery, demonstrated during the bombardment of castles and town walls in the French invasion of the Italian peninsula in 1494 (Hughes 1991: 62). In the region, artillery used by Sir Thomas Wyatt's rebel forces at the siege of Cooling Castle in 1554, helped bring about its surrender (Cruden 1843: 181). In the broader scheme of things, the role of the knight at arms and associated levies lessened in favour of reliance upon militias, controlled by royal Lord Lieutenants, as well as upon small regular forces and contract troops raised for the duration of need (Allen Brown 1976: 128 et seq). Parallel with this, the silting up of some of the Cinque Ports compromised their function, and in

consequence reduced their prosperity, and hence their ability to contribute ships to the defence needs of the Crown (Lawson 2004a). Increased attention was given to the launching of royal warships for a Crown fleet. These incorporated the use of guns in increasing numbers, a process paralleled in the navies of the European states. Many English ships were built in private yards, before royal yards predominated (Howard 1979: 13 et seq and Rule 1983: 14 et seq).

Although no longer premier defensive architecture, castles could be made defensible if need be. Because it overlooked a key port, the royal castle of Dover continued in use, later embraced within more modern defences (Coad 1995). Canterbury's walls were falteringly maintained, but this city remained strategically important as a node of road communications in East Kent (Turner 1971: 148-54).

***The strengthening of the Crown and a new emphasis on systems of defence***

By the start of the 16th century royal control of government and of defence had become stronger. Protection against external threats gained more emphasis. Beginning under Henry VII and gaining pace under Henry VIII most defences, whether coastal forts or warships, were conceived, built and controlled by the Crown. The greatly enlarged fleet established by Henry VIII, much of it based at Portsmouth, was, in effect, a home defence squadron for maintaining naval supremacy in the English Channel. The region drew its maritime protection from this (Saunders 1997: 31; Childs 2009). Governmental attitude to naval and coastal defence of the nation became increasingly strategic in scope. On land this expressed itself in systems of defence rather than as individual works (Hale 1982: 367-401). With this went increasing self-sufficiency, the fostering of an English gunpowder manufacturing industry and the casting of guns, for example at foundries in the Weald (Saunders 1989: 22-52).

***New approaches to the design of fortifications***

By the 1520s-30s the progress of artillery meant that land based defences could now engage enemy ships at a distance, beginning the centuries-long ship/shore competition for superiority with ever more powerful and longer range weapons. Unlike earlier fortifications which adapted earlier design traditions to gunpowder weapons, the new ones were designed around the use of the gun, resulting in buildings lower in height, with rounded forms and shaped parapets to deflect incoming shot or with earthworks which absorbed them, sometimes both (Morley 1976). These developments were elements of what Geoffrey Parker has labelled a European 'Military Revolution', characterised by a range of distinct changes in the organisation, weaponry and place of war and of defence in society (Parker 1988).

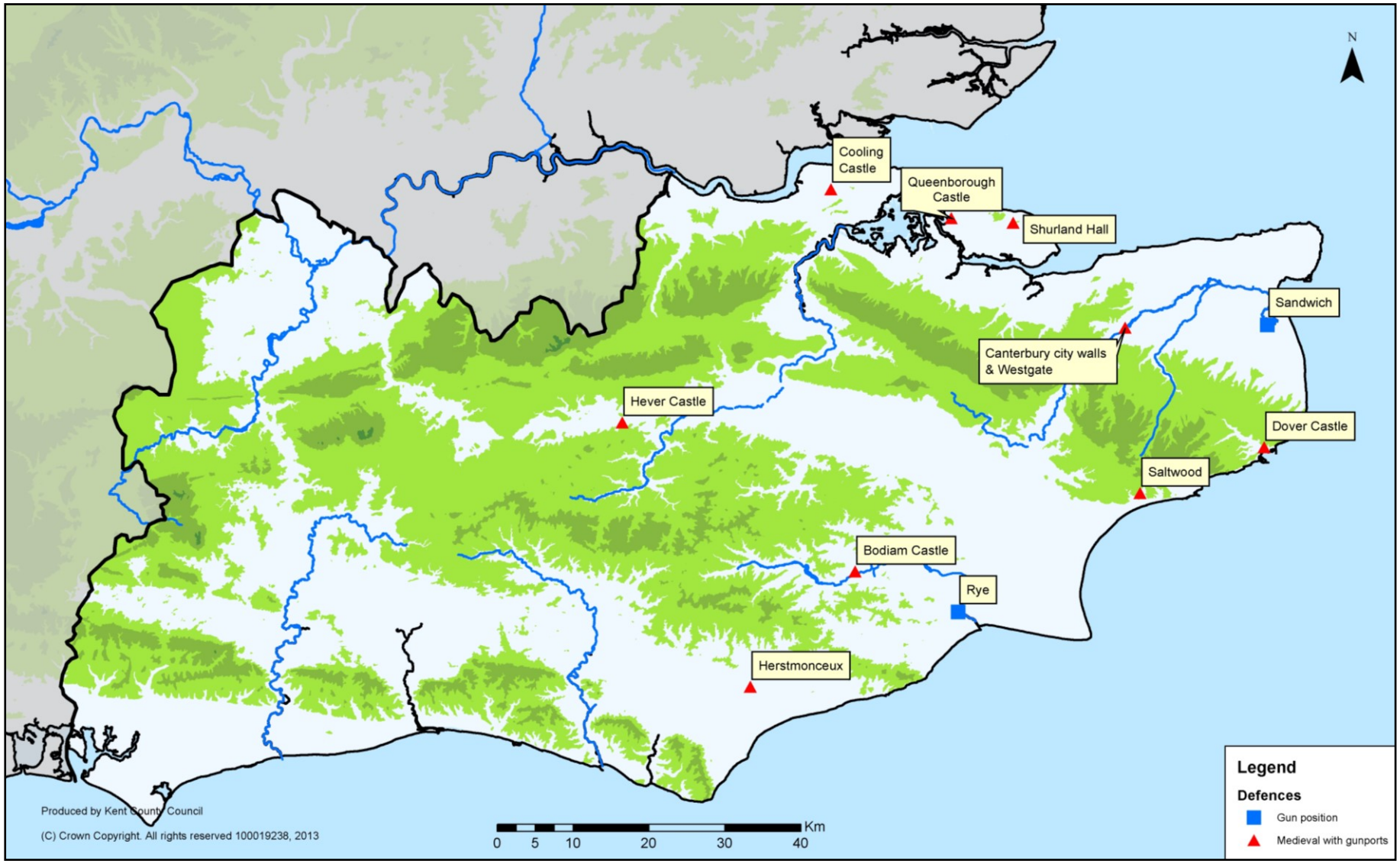


*Figure 1. Map of sites considered in the text that show evidence of adaptation to the age of gunpowder*

***Focussing the building of defences on the most important strategic points***

It was unrealistic to defend the whole coastline, so efforts were, in support of a naval defence strategy, mainly concentrated upon securing the more important anchorages, harbours and landing grounds with permanent works. In time of war, these could be supplemented with extemporised works. There were no successors to the earlier castles inland. Even London's walls were falling into decay, although the Tower of London was maintained as a royal citadel, if sometimes challenged politically by the animosity of the elite of the surrounding city. The Tower was to be provided with artillery (Smith and Kelsey 1998).

In the region, modernisation for artillery began in the early 16th century, with a round gun tower built in 1512-14 at Camber (later supplemented with additional works, to defend a then existing harbour) (Biddle 1982b: 415). Camber Castle is now a visitor heritage site. Two other round towers (no longer existing) of about the same date as that at Camber, protected Dover Harbour. Although this port was strategically important to England, at least one of the towers at Dover appears to have been built by the local community (Biddle and Summerson 1982: 729). In 1539-40 the Crown planned and built five small artillery blockhouses crossing their fire from the banks of the Thames to defend the approaches to London: two at East Tilbury and Higham in an outer line and three at Tilbury, Gravesend and Milton forming an inner line (Smith 1974: 142-8). Following excavation the stabilised foundations of the D-shaped Gravesend blockhouse were left exposed to view and the Milton one is surface indicated (Colvin and Summerson 1982a: 602). Both have scope for continuing archaeological investigation. Multi round-bastioned forts guarding the Downs anchorage and landing beaches at Walmer and Deal are impressively intact, with a ghost of a third fort at Sandown (Biddle 1982a: 455; Lawson 2004b; Pattison 2018). Connecting banks and bulwarks between Walmer and Deal may have left traces, perhaps discoverable archaeologically; the excavations at Camber have shown the investigatory potential of these sites (Biddle *et. al.* 2001). A fort at Sandgate displays rounded forms and commanded an important coastal road and an anchorage (Biddle 1982c: 569-70). To defend the port of Dover, whose harbour was enlarged in the 1530s and 40s and in which a small flotilla might, if necessary, be based to act in the narrow seas, were three, later four, small bulwarks (no longer extant). In 1544 the port had a major role in the transport of supplies for English military operations in France. Study is needed to explain why for such an important place, Dover's defences were, at this period, so rudimentary and outside the mainstream of contemporary design. A bulwark in the ditch of Dover Castle, and near the cliff edge, may date from this period. In the last year of Henry VIII's reign, a need to protect the approaches to the evolving fleet anchorage in the Medway led to construction of a blockhouse at Sheerness and two others on Sheppey and Grain, all long-vanished, (Colvin and Summerson 1982b: 477-8). Something is known of the plan of the multi-angular Sheerness blockhouse but not of the others. Queenborough Castle was also re-adapted for artillery (Colvin and Summerson 1982b: 479) but details are unclear. Requiring explanation, the West Sussex coast appears to have been left undefended, so far as Crown initiatives were concerned, but a bulwark existed at Brighton (perhaps built 1497, possibly a local initiative) and this may have been armed with artillery (Goodwin 1985: 3).

***The context of design***

These new defences had a north-west European frame of reference, apparent in their plans, shapes, gunports and smoke vents. A Moravian engineer, Stefan Von Haschenperg, was influential in the design of two of them (Saunders 1989: 44). The experience of European warfare by the English designers is apparent in others, and Henry VIII may have personally contributed to the designs (Hale 1982: 367-401). In 1545-7, an early angular bastion was added to Milton Blockhouse at Gravesend (Smith 1980: 341). This form ultimately originated from the influence of design innovation in Italy during the 15th century. When it came to the French raiding of 1545, however, it was not Kent and Sussex but the Solent and the Isle of Wight which were attacked (Saunders 1989: 50).

## *Continuing defensive measures and the emergence of the Spanish threat*

Despite a number of the coastal defences being abandoned in 1553 to cut costs (Smith 1974: 148), the growing importance of the Medway naval anchorage led in 1559 to the building of Upnor Castle for its defence. This had a single storey barrack with end towers, and another new-style angular bastion projecting into the river. It was improved between 1599 and 1601 when, going against the trend of decreasing profiles to better withstand artillery attack, it was increased in height, giving it the almost medieval appearance it has today. The reason for this anachronistic development is not yet fully understood. (Saunders 1967: 8; Coad 2017). We need to know how the defences at Grain and Sheerness fared during this period. Elsewhere, guns were mounted within Dover Castle to overlook the harbour (Coad 1995: 54) but precise details are unknown. In 1559, a no-longer-extant tower was built on Brighton's seafront (Goodwin 1985: 16). There may have been other local defences along the coastline, knowledge of which should be sought. From 1579-86 Dover's harbour was in the process of enlargement, mainly in the end years of this period, with lesser expenditure following but leading to completion by around 1595. More generally, the fleet figured ever increasingly as the key instrument for home defence. (Biddle and Summerson 1982: 729; Found 2019, pers comm).

For a time English diplomacy prevented direct involvement in Continental wars. But English assistance in 1585 to the Dutch seeking independence from Spain, and attacks on Spanish interests in the Americas and the execution of Mary, Queen of Scots, in 1587, were seen by Spain as aggravating and provocative. Known to English intelligence, Spain began preparations to invade (Smith 2001: 25 and Martin and Parker 1988).

### *Measures to defend against the Spanish Armada*

During the Armada emergency the Thames and Medway were protected with boom defences (Boynton 1967: 13), perhaps at Dover also, possibly with additional temporary fortifications being built (Smith 2001: 26). A field army was encamped at Tilbury, with other troop formations elsewhere. Earlier defences at Brighton may have been activated (Goodwin 1985: 54). There were the fire beacons at observation points along the coast, connecting on lines of sight with others inland for the passing of invasion alerts. Arrangements for mobilisation of the field army or militia were set out in documents (Kitchen 1986; Martin and Parker 1988: 265). The Lord Lieutenants of Kent and Sussex were instructed to report on the vulnerability of the coast and to

recommend points needing to be provided with works. Evidently English warships had been resupplied with ammunition from coastal batteries along the Sussex coast (Goodwin 1985: 9). The Armada defence map of the Thames (Adams 1588), as well as associated contemporary documentation, raise as many questions about the actual extent of defensive measures as they provide answers. Defensive additions at Gravesend and Tilbury by the Italian engineer Gianibelli are suggested. Local initiatives at various coastal points and havens might have been taken and this needs to be investigated (Smith 2001: 26).

## *The 17th century – the Stuarts, Civil War and the Dutch threat*

The period immediately following the Armada's defeat might be assumed as having offered something of a breathing space, whilst Spain rebuilt her fleet but there were invasion scares in the 1590s and in 1601, when the Spanish landed in Ireland (Martin and Parker 1988: 264). The early Stuart period was generally a period of inaction and decay for the coastal defences. There were some exceptions, most notably in the rebuilding in the early 17th century of Archcliffe Fort at Dover, whose land front survives (Welby 1991: 5). The batteries at Baye and Warham in the Medway might also owe their origins to this period, perhaps dating to 1603 (Saunders 1967: 9).

### *The Civil War*

From the start of the Civil War in 1642 much of the region came under Parliament, being part of its south-eastern powerbase (Duffy 1979: 148). London was provided with an 18km ring of lines and forts, whose design may have been influenced by the form of fieldworks built or observed by English engineers in recent Continental campaigns. Some archaeological traces have been found of these short-lived defences (Smith and Kelsey 1998: 117). Farnham, near the western fringe of the region became a Parliamentarian stronghold. In 1642, Parliament authorised Chichester to make fortifications (Harrington 2003: 16) and royalist Arundel Castle was besieged by Parliament in 1643 (Goodwin 1985: 23). Kent was the seat of a royalist rebellion in 1648, which saw skirmishes at Gravesend, in and around Maidstone, as well as a Parliamentarian siege of Walmer, Deal and Sandown Castles which had defected to the Crown and a royalist attempt to capture Dover Castle (Smith 2001: 29; Pattison 2018: 27; Coad 1995: 56). The Thames blockhouses were security posts (Smith 1974: 154), as was Dover Castle (to which a bulwark, later called Oliver's Mount, may have been added) (Coad 1995: 56). There was an earthwork at Barham Down (O'Neil 1960: 37) and there was perhaps another defence at Squerryes court (Saunders and Smith, 2001). In other respects, most – though not all – of the region was outside the action during the mainstream civil war (Duffy 1979: 145). The few defence works that were constructed, plus the sites of the skirmishes that did occur, hold potential for investigation (Foard 1995; Howe et. al. 2005).

### *The Dutch Wars*

With the Commonwealth (1649-60) came commercial tension with the newly independent Dutch state, whose fleet was defeated off Dover in 1652. Post-Restoration, strained relations continued, still largely caused by the competition for commercial opportunities overseas. War resulted from 1664, symbolised by the Dutch raid on the Thames and Medway in 1667 when, within sight of the enemy fleet, temporary defence works were hurriedly made (James 1967). In the Medway the Dutch slighted an unfinished new fort at Sheerness, also overcoming extemporised batteries and a cross-river boom upstream at Hoo Ness and Gillingham, before moving on to capture and burn warships of the English fleet moored in the river. In the Thames, a new (since vanished) battery, called Trinity Fort was built at Gravesend, and there were block ships across the river joining with the Tilbury shore (Smith 1994: 39). Not knowing where the Dutch might have struck next – and they went on to attack Landguard Fort in Suffolk - there may have been other places, not least at Dover, at which emergency measures were taken (Smith 1994: 39-50).

Greater is the evidence for the post-raid defences designed by De Gomme to secure Sheerness, and to protect the river approaches to Chatham's dockyard, in the form of forts at Cockham Wood (where there are remains) (Smith 1993: 55) and at Gillingham (vanished) (Saunders 1989: 92). De Gomme's greatest achievement was the large new bastioned fort on the north side of the Thames at Tilbury and which today still powerfully asserts its presence. This incorporated both French and Dutch design influences (Saunders 1960: 158). By the War of the Grand Alliance (1689-97), with England and Holland allied against France, three batteries were added at Grain in the Medway, with the two between Cockham Wood and Upnor restored and a new battery at Hoo Ness (Saunders 1989: 92). There were others at Oakham Ness and Bishops Ness (Found 2019, pers comm). Some may be traceable from fieldwork and yield important evidence. Upnor Castle was no longer a gun platform, having been converted into a storage magazine for gunpowder to supply the fleet. (Saunders 1967: 15).

### *The 18th century – reaction to Continental wars and major new schemes of fortification*

The 18th century opened with a succession of French wars and invasion scares, leading to major fortification schemes, particularly between the 1740s and 1780s. New defences in the Medway reflected its growing importance as a naval base and for the building and repair of warships. Expansion of Chatham's dockyard led in 1755/6 to its enclosure by extensive bastioned lines, demonstrated in their considerable survival. These display a European universality of form (Saunders 1989: 120). Recent investigations have discovered evidence of the associated infantry barracks (Found 2019, pers comm). Enlargement of the dockyard at Sheerness also resulted in protection by lines and outworks in the 1780s, leaving impressive but later refaced survivals (Saunders 1989: 128). This was paralleled by the building of counterpart fortifications for the Portsmouth naval base, so important for Channel defence (Saunders 1997: 59).

Naval victualling centred at Deptford in the Thames, with supply bases at Sheerness and Chatham, Deal and Dover (Coad 2007, pers comm). Dover's strategic importance led to the castle's modernisation for artillery in the 1740s- 50s, noticeable in its

truncated medieval towers and other works (Coad 1995: 58). During the later 1770s fieldworks were made on the Western Heights. These moves allowed the port to be used, if need be, as an entrenched camp for a field army to act against an invader landing elsewhere in the region (Coad 1995: 58 and 66). Money was also found for the construction of four batteries to defend the harbour: Guilford, North, Townshend and Amherst. As well as this, new batteries were built from the 1760s to defend the smaller harbours along the Sussex/Kent coasts, leaving traces at Folkestone, Littlehampton and Rye (Goodwin 1985: 21). Other sites were Langney, Newhaven, Brighton and Seaford (Goodwin 1985). There was further activity during a French invasion scare in the later 1770s, with additions to Chatham Lines and new batteries on Thanet (Maurice-Jones 1959: 51). In the Thames there were modest additions to Tilbury Fort (partly surviving) and the building of a new fort to cross fire with it at New Tavern, Gravesend, whose outline was continued into later periods of this work (Smith 1998).

***A more strategic approach***

Although executed over several decades, these schemes of defence began to manifest an increasingly strategic approach, which left less necessity for local communities to take their own action. Particularly at Chatham, Sheerness and Dover, there was more emphasis on the provision of barracks. This reflected an understanding that designed living environments, within a controlled military area, produced better and more disciplined soldiers (Douet 1998: 29). Military communities (at Chatham and Sheerness, naval ones) had a stimulating effect on local economies, through both the personal spending of individuals and the need for the Crown to make some of its supply purchasing locally. There was also the use of army training camps during the summer at Chilham, Barham and Coxheath (Douet 1998: 129). At a local level, there has been exhaustive research on the Chatham bastioned lines and on Dover (Coad and Lewis 1982; Kendall 2007/2010/2012; Kendall and Holman forthcoming), but less so Sheerness.

## *The French Revolutionary and Napoleonic Wars (1793-1815)*

During the Revolutionary-Napoleonic wars Britain faced invasion by unprecedentedly large forces. In a departure from earlier perceived defensive practicalities, attempts were made to defend whole lengths of the region's coast and hinterland (Bloomfield 1987; Smith 2004). This was not as a single event, but a process carried out over 20 or so years. Moreover, the effects of war were increasingly felt by the civilian population, in the preparations made for defence and the demands made on them by the militia ballot (Glover 1973). Parallel with this was the continuing growth of a standing army.

***Grand strategy applied to home defence***

From around 1793-1800, what was in effect a defensive line was made along the region's coast, consisting of a large number of batteries, some having a new, distinctive triangular plan, supported by redoubts and ammunition magazines

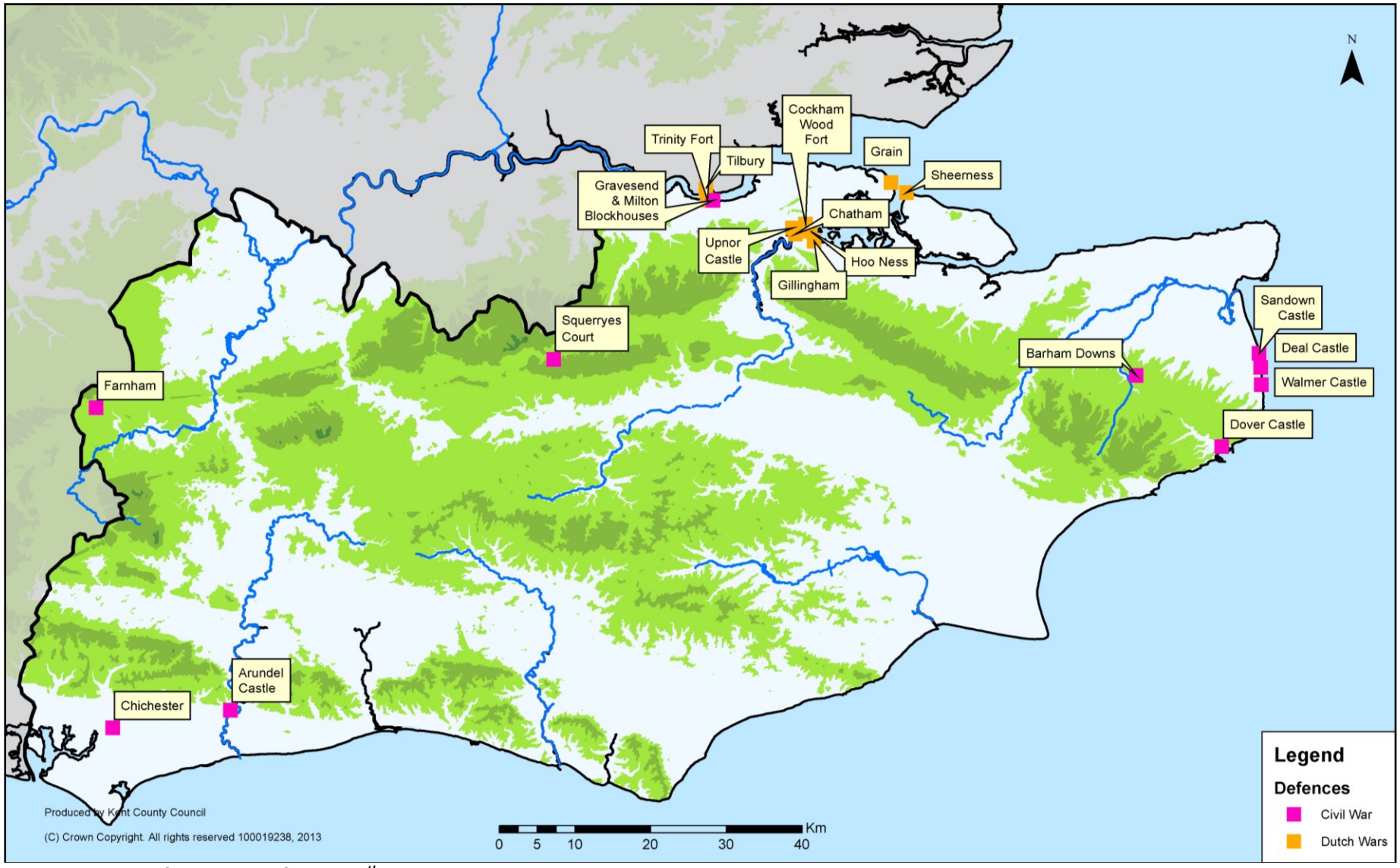


*Figure 2 Fortifications of the 17th century considered in the text.*

(Bloomfield 1987: 180). One of these survives at Lade in Kent. There has been recent archaeological evaluation of the Dungeness Redoubt which formed part of these defences (Found 2019, pers comm).There were also 'stop' lines inland, apparently including fieldworks (Bloomfield 1987: 103; Goodwin 1985: 65). New camps and barracks were provided for the defending forces, giving them the ability to deploy to threatened areas. Inland were further ammunition and food stores (Douet 1998: 67). Shorncliffe became a major military centre (Bloomfield 1987: 41 and Douet 1998: 86 and 134). As part of the defensive preparations a chalk ridge communication road ran along the North Downs in Surrey (Saunders 1989: 144). The initial phases of defence were elaborated upon from 1805-8 with (a) construction of coastal Martello Towers - supplemented by the grand redoubts at Dymchurch and Eastbourne that also provided store depots and barracks to support the chain of towers and acted as forts in their own right - (Clements 1999; Sutcliffe 1972; Telling 1997; Found 2019, pers comm), as well as (b) the cutting of the Royal Military Canal (Clements 1999: 17; Vine 1972). The fire beacons were put back into service and various incarnations of flag, shutter telegraph and semaphore signalling appeared as part of a communication network, with stations at the ports, on the coast and inland across the region, offering speedier transmission of messages for directing military and naval forces. (Goodwin 2000; Wilson 1976). There are traces of these and sites with the potential for archaeological investigation. At Dover the Western Heights were rebuilt into a permanent system – including the famous Grand Shaft triple staircases (recently evaluated by the Canterbury Archaeological Trust (Found 2019, pers comm). There were other – still surviving - additions at the Castle, some containing caponiers (Coad 1995: 82), elements of what came to be polygonal fortification. There were several - now vanished - batteries at Brighton (Goodwin 1985: 66) and at the eastern end of Gravesend Reach in the Thames at East Tilbury, Shornemead and Hope Point (Smith 2002: 17). Inland at Rochester and Chatham were built Fort Clarence with a connecting line, both remaining, as does in part the also new bastioned Fort Pitt, and extensions to and strengthening of Chatham Lines, including the incrementally added to large and impressive Fort Amherst complex. Part of the latter was archaeologically excavated in 2018 (Found 2019, pers comm). Fort Amherst is open to the public and is an important heritage tourism resource (Gulvin undated; Kendall 2007/2010 Saunders 1989: 144). New barracks in towns (e.g. Brighton, Guildford, Deal, Dover, Canterbury and Maidstone) came to affect the urban development of those places (Douet 1998: 67). Although the increase in barracks in the late 18$^{th}$ century was fundamentally due to the French wars, it was, as has been noted, in part beneficial for security against the increase in radicalism at home (Ballinger 2000; Douet 1998; Hudson 1986). Many barracks from this period have since disappeared though some sites still have buildings preserved and limited historical work has been done on individual sites (Smith 1995; Found 2019, pers comm).

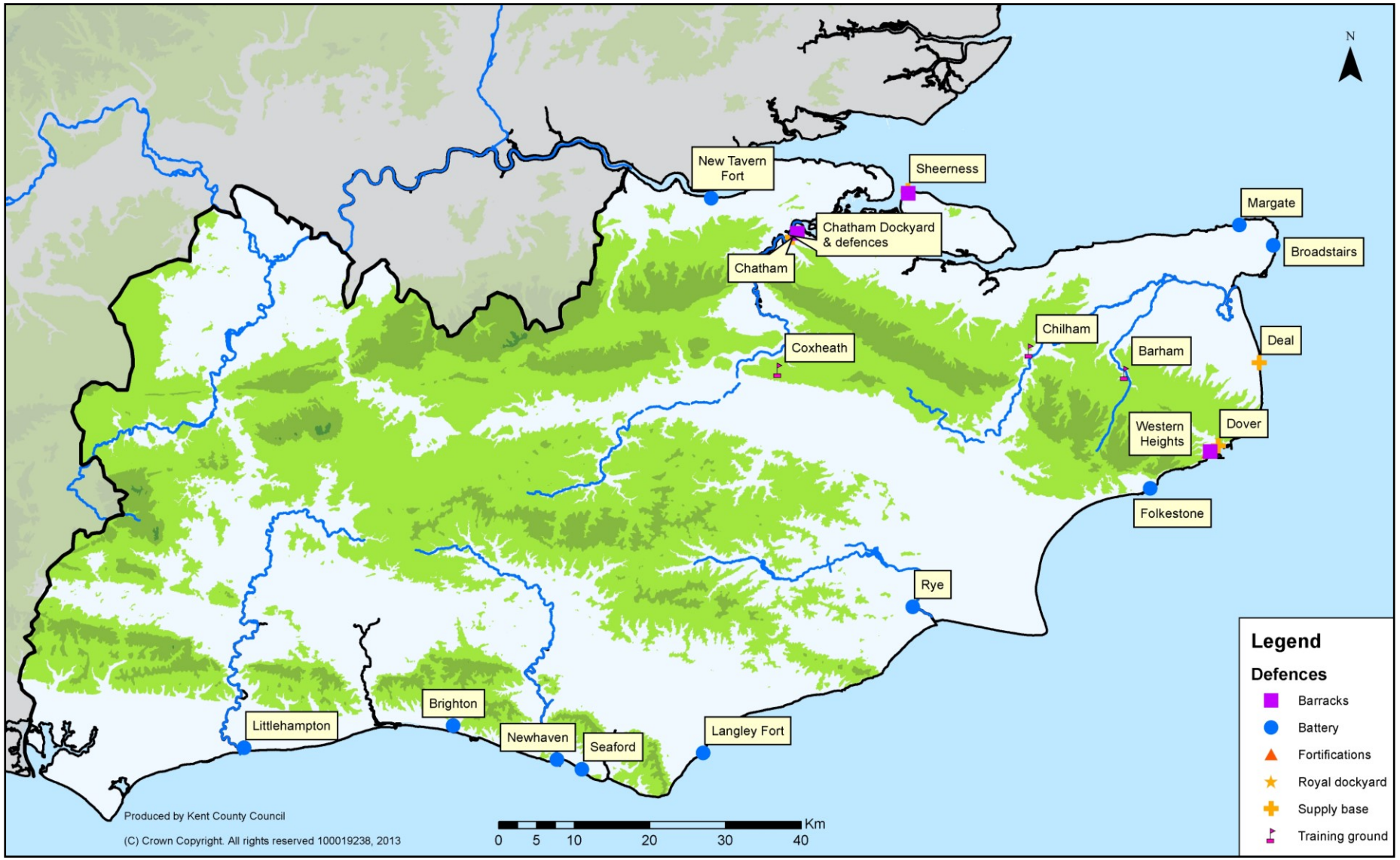


*Figure 3. Fortifications of the 18th century considered in the text.*

The combination of naval power in the English Channel and the coastal defences was intended to provide a comprehensive protection for the vulnerable landing beaches. Indeed, the Region's defences had been conceived on an epic scale, not equalled until the Second World War. Some of the coastal defences demonstrate architectural and technological advances which were to become long-lasting features of English defences; bomb-proofing of barracks, gun positions and magazines within protective casemates and the use of traversing platforms to turn guns more rapidly on to target (Saunders 1989: 137).

Documentation of defence during the French wars has been reviewed and considered in several places (e.g. Bloomfield 1987; Glover 1973) but its possibilities are far from exhausted. Undated military earthworks in various places, visible as cropmarks, may date to this period, or to a subsequent one. Temporary positions could be more numerous in the region than previously recognised, potentially relating to troop movements or invasion scares. The sites of numerous tented camps are known such as those in the Ashdown forest (Butler 2007) where a number of 18th-century field kitchens have been studied (Margary 1965). Generally archaeological work on sites of this period has been limited (cf. Smith 1996), even on distinctive major features such as the Royal Military Canal (Greatorex 1995).

### *After the Napoleonic Wars and before the Royal Commission*

After the Napoleonic Wars ended in 1815, defence construction was rapidly completed or suspended, some defences being given over to 'care and maintenance', many being disarmed. The coast blockade occupied some Martello Towers. At Chatham, the fortifications of the Lines were increasingly given over to training exercises, sometimes large in scale (Found 2019, pers comm). Despite defeat, France recovered and concerns about the possibility of war and invasion arose again in 1825 and 1830 (Smith 2001: 54). This stimulated defence planning, but it is unclear how much there was consequential upgrading of works. However, there ensued an important and revolutionary technological advance at sea which appeared to threaten the defence of Britain. This was the use of steam power to supplement sail for the propulsion of warships, which could rapidly reach the English coast, perhaps without warning (Saunders 1989: 160-1). A spur to defensive action was the perception of this risk during a period of invasion anxiety from 1847-52 arising from revolution in Paris and the coup of Napoleon III (Saunders 1989: 162). Dover had been earmarked as a naval harbour of refuge in 1840 and the Admiralty Pier was begun in 1847 (Coad 1995: 91) but it is unclear whether it had defences (Smith, 2001: 55). Considerable enhancement of Dover Castle's defences and those of the Western Heights followed from the 1850s, leaving a substantial structural signature of new works, batteries and casemated barracks at both places (Coad 1995: 92). Rejection of the bastion system was expressed in the innovative Shornemead Fort built in 1848-52 on the south bank of the Thames in the new polygonal style, perhaps reflecting Prussian design influences (Smith 2002: 20). There were two lunette forts at Littlehampton (1854) and Shoreham (1857), (Goodwin 1985: 37 and 46) both with French-influenced Carnot walls, and with

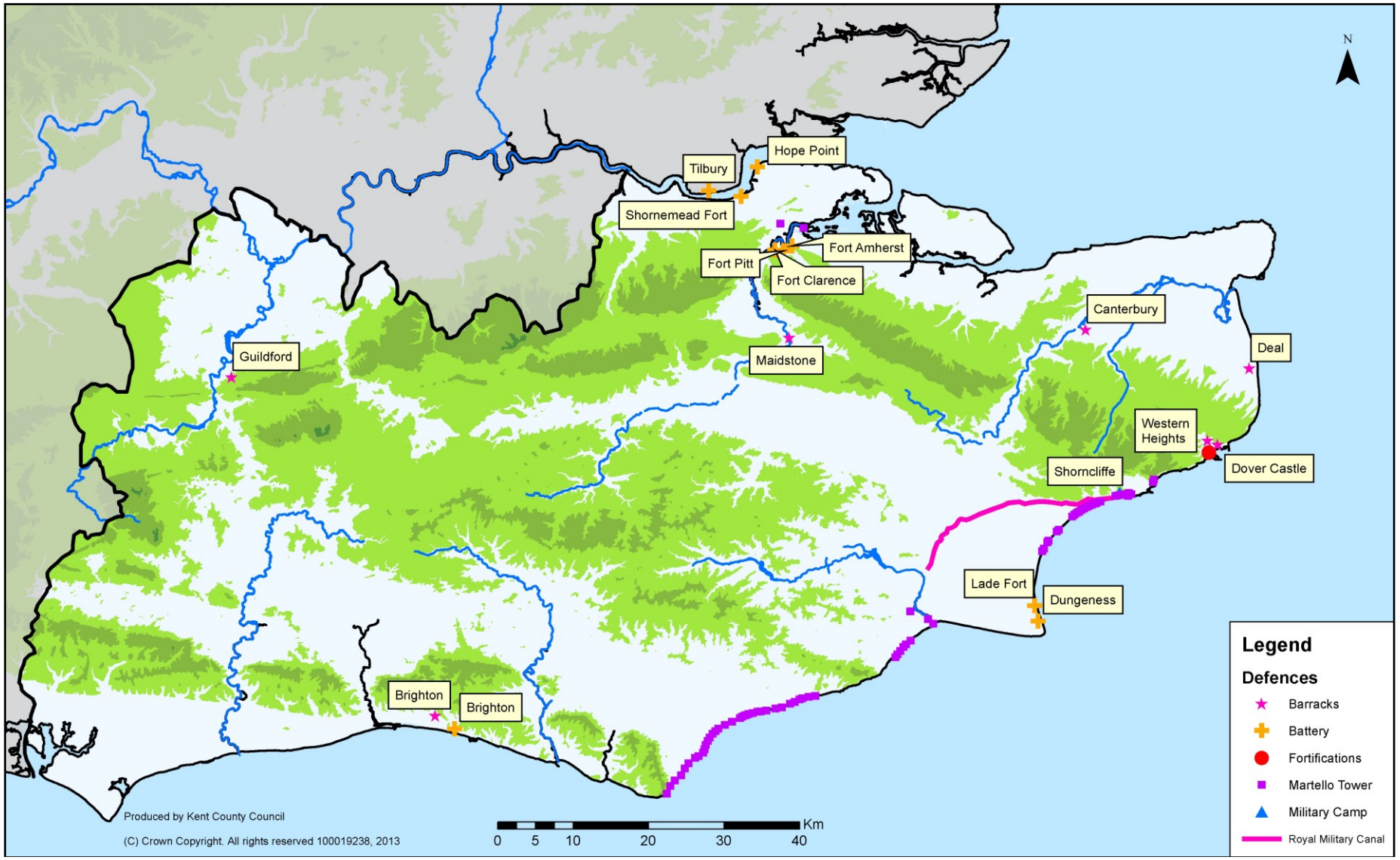


*Figure 4 Fortifications of the Revolutionary and Napoleonic Wars considered in the text*

caponiers at Shoreham. The latter is open to public view. There was also a lunette at the entrance to Newhaven harbour (1855) (Goulden and Kemp 1974: 8). A late Martello Tower was built at Grain (1855) (Smith 2001: 56). There were numerous examples during the same period of older, existing batteries being upgraded with more powerful weapons (e.g. Bayle Battery at Folkestone).

In 1853 on Chobham Common (Surrey Heath) a great camp was formed at which were held the first large-scale military manoeuvres in Britain for 40 years, apparently modelled on the 1792 Bagshot Camp. Rather later in 1871 earthworks were constructed there as part of another manoeuvre (information from Surrey County Council's Heritage Conservation section).

## *The forts of the Royal Commission*

### *Technological causation*

The iconic technological naval challenge which proved so worrying and game-changing was the launching by the French in 1859 of the *Gloire,* a powerful steam ironclad frigate armed with rifled guns. This combination outclassed Britain's vulnerable wooden wall navy and her coastal defences, both armed with obsolescent smooth-bore ordnance. At the same time, there was also concern about the geopolitical agenda of France and her intentions towards Britain. Once again and however justified, there emerged an anxiety about whether relations with the French might worsen and lead to war and, should this occur, there was the possibility of invasion. The reaction was the start of a British programme to counter French naval advances with similar but more powerful warships, exemplified by the launching of *HMS Warrior* in 1860. On land and initiated by the recommendations of the Royal Commission on the Defence of the United Kingdom, set up in 1859, there was a major programme of defence construction, chiefly for the protection of naval bases and harbours (Hogg 1974: 27 and Saunders 1989: 171). Alongside re-fortification was major expansion of barracks to provide soldiers' accommodation. This included improvements to living conditions, as well as to those within married quarters. There was also an expansion of the militia and the volunteers, as well as the building of drill halls and additional rifle ranges (Douet 1998: 151). Once again, the Portsmouth naval base – with its western counterpart at Plymouth - had an enhanced importance for Channel defence, especially following the construction by the French of what was perceived to be a threatening new naval base at Cherbourg. The first steps were also taken at Chatham to modernise its dockyard for the construction and repair of the new classes of warship which were starting to appear.

### *Arming and construction*

In the 1860s the Thames and Medway saw the building of new forts at Shornemead, Cliffe, Coalhouse and Slough (Thames) and at Grain, Garrison Point, Sheerness as well as at Hoo and Darnet islands (Medway), together with the modernisation of existing ones at Tilbury and New Tavern in the Thames. But it took until the end of the decade and even a little beyond, for them to be fully armed with their rifled muzzle-loading guns, which were mounted on new types of mechanical carriages. Many of the guns were behind iron shields set in massive granite casemated emplacements

but others were in unshielded and open positions. They were served with ammunition by lift from underground magazines illuminated by safe-lighting systems and provided with voice-pipe communications (Burridge 2001; Crowdy undated; Gulvin 2000; Hughes 2002; McDougall 1980; Saunders 1960: 167; Smith 2002; Smith 2004; Wilson 1963). These forts expressed the achievements of the maturing industrial revolution, which included the ability to form metals into the latest weapons of war, new forms of building construction and advances in chemical engineering for propellants and explosives. But it was not long before further advances in armament technology began to catch up with them. These forts have left a significant surviving signature and some in the Thames (Tilbury, New Tavern, Coalhouse and Slough) enjoy public heritage access.

This period also saw the setting out of the Queenborough Lines as advanced landward defences for Sheerness and its naval dockyard (Saunders 1989: 131). The Lines are preserved as a heritage walk and the seaward defences of Sheerness can be viewed at a short distance from the esplanade. Dover's Western Heights defences were completed, making them into a large and powerful fortress and there were additions to the defences at Dover Castle as well as the construction of Fort. Burgoyne to landward of the castle and the modernisation of Archcliffe Fort (Coad 1995: 98). In war, Fort Burgoyne and the Western Heights defences could be connected by fieldworks, closing off access to Dover from the rear. No armour was used at Dover, most of whose sea defences were less vulnerable to fire because of being high up on cliffs. The armament of the more vulnerable Archcliffe Fort down at water level was given protection by being mounted on disappearing carriages (Welby 1991: 10; Smith 2001: 62). These defences survive in varying degrees of preservation, with public access to Dover Castle and to parts of the Western Heights. Although not part of the Royal Commission scheme, Battery No. 1 at Dungeness (mostly demolished) (Smith 2001: 62) was rearmed with rifled guns and a powerful fort was built on the cliffs at Newhaven on the East Sussex coast, now a major tourism destination (Saunders 1989: 187). Research has been carried out on the development of these defences through time (Smith 1985), although only limited excavation work has been undertaken (Anon 2003: 306-7). The living spaces created for soldiers in the forts reached a high point not to be later significantly improved upon. Parallel with this, Cardwell's Reforms resulted in the distribution and localisation of regimental recruitment areas and headquarters, producing a changed national pattern of provision (Douet 1998: 167).

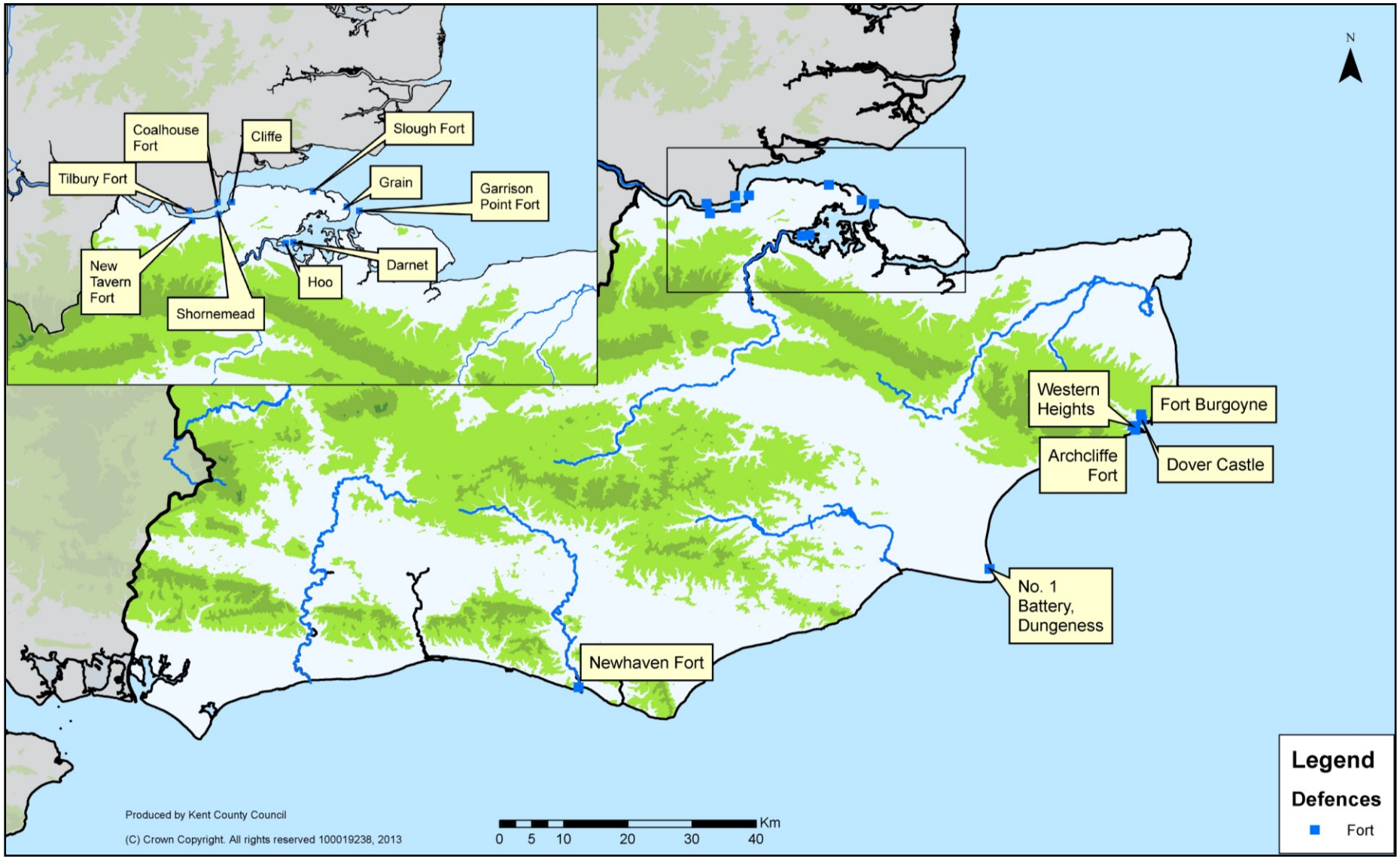


*Figure 5 Forts of the Royal Commission considered in the text*

### *The Chatham ring fortress and dispersed defence*

In the last quarter of the 19th century the approach to the defence of land-facing fronts changed in response to advances in the power and range of artillery expected in the armaments of a potential invader, not least of the new breech-loading guns which were rapidly superseding the rifled muzzle-loaders. Added to this, in time, was the dramatically increased destructive effect of the new high explosive filling for shells. This process was reflected in the evolution of the new Chatham ring fortress built from 1875-99 to defend the expanded Chatham dockyard against attack and capture from the land. Exposed caponiers planned for ditch defence of the forts were mostly rejected and less vulnerable recessed counterscarp firing positions were substituted (Lloyd 1883: 164-79). Moreover, the earlier assumptions of the designers of works for land fronts which had been so outpaced meant that in England, especially at Chatham, forts became considered too vulnerable to act as fixed gun positions (Smith 1985: 113). What followed was a fundamental shift for British fortification in that heavy artillery, increasingly breech-loaders, was now to be positioned, when required in war, in dispersed places within fieldworks to be formed outside the forts, making them more difficult for an enemy to see and, therefore, to hit. The defence of the fortress against infantry assault was now to be from the new rapid firing magazine rifles and machine guns which advancing technology had made possible. Light moveable quick-firing guns were also allocated to the forts, now becoming infantry redoubts in support of the externally placed heavy guns. The innovative Twydall Redoubts in the north arc of the Chatham ring fortress achieved near invisibility of form. Experimentation at Lydd Ranges and elsewhere influenced the designs at Twydall and beyond. Archaeological remains of the experimental works at Lydd survive (Found 2019, pers comm). The developments at Chatham fostered a new tactical doctrine for English fortress warfare (Smith 1985: 11). The fortress, with three of its seven works surviving in good condition and two in a fragmented state, displays novel characteristics and design, together with the extensive use of concrete in construction, contrasting with the earlier ring fortresses at Portsmouth and Plymouth (Saunders 1966). In 1907 the Chatham ring fortress was subjected to practice siege operations, similar to those carried out on the Chatham Lines since the 1830s (Kendall 2007/2010). The exercises were carried out against Forts Luton and Bridgewoods (Royal Engineers 1907). This caused some damage, but the forts were reinstated (Smith 1978: 87).

## *The continuing march of technology and coastal defences*

Much of the later 19th century continued as a ‘Cold War’ with France, kept alive by old enmities and exacerbated by colonial competition (Moon 1968). During the same period, the already noted advances in ordnance technology from muzzle-loading to breech-loading were to have dramatic effects on the coastal defences. This was one element of what amounted to an arms race with France, seeing also rapid advances in the power of the warships of the respective navies. An epic last gasp of rifled muzzle-loading on land was the building in 1878 of a massive armoured turret for 2 x 16-in. guns on the Admiralty Pier at Dover (Burridge 1987), one of the more important defence heritage assets remaining in the region from the later 19th century.

Following an early, limited and less successful use of rifled breech-loaders (RBLs) in the 1860s, modernisation of the coastal defences to breech-loading began in the later 1880s/early 1890s (Saunders 1989: 196), resulting in changed battery architecture. The new guns were on centrally-pivoted mountings in less visible low-profile concrete emplacements allowing a wide field of fire. Initially some were on disappearing carriages which, by recoiling on firing into a pit and out of sight, conferred protection upon them. But development soon concentrated upon the less complicated barbette mountings which relied for the protection of their detachments on their smallness of target when viewed at a distance and upon thick shields fitted to their carriages. A new threat was of the fast torpedo boat liable to race into defended ports and anchorages to attack naval and merchant shipping. This gave rise to the development of the light quick-firing gun (QF) emplaced on land and on warships to defend against them. Preparations against this threat also included the use of boom defences in rivers and harbours, as well as minefields for protection against all classes of warship. Some of the coastal battery sites have been subject to demolitions and burial. Examples may however be seen in the Thames and Medway, at Dover and Newhaven, whether added to the roofs of existing forts or in new battery structures. These had Battery Observation Posts, utilising the science of optics, trigonometrical calculation and electro-mechanics for range finding and command and control, further important technological developments of the period. The military application of electricity was pioneered in the region at this time, with experiments having been undertaken earlier in the 1860s in relation to signalling and, soon after, into the development of searchlights (Kendall and Holman forthcoming). For example, the earliest see-saw searchlights, suggested for use in defences, were trialled at Sheerness and later at Chatham (Kendall and Holman forthcoming). Searchlights harnessing electrical and carbon-arc technology to allow illumination of targets at night were provided for many coastal batteries from the 1880s. Except for a small number of the see-saw design, these were circular metal-cased projectors mounted within concrete or brick cells, the light shining out from them over the area to be illuminated, either as moving or fixed sentry beam (Smith 2001: 107: Maurice-Jones 1959: 174). Technological innovation is also apparent in the installations for the short-lived wire-guided Brennan Torpedo at Cliffe and Garrison Point forts in Kent in the 1890s, with a factory for construction of the torpedo at Chatham (Smith 2001; Smith 2002). Electric telegraphy and telephones facilitated rapid and indeed instantaneous tactical communication. The restored and re-armed Newhaven Fort in Sussex as well as New Tavern Fort and the partly armed, Slough Fort in Kent, are the best surviving examples in the region from this period.

***Naval defence***

The naval dimension of the arms race expressed itself in the competition between Britain and France to develop faster, better designed and more strongly armoured and armed warships to carry the new breech-loading weapons. These were less reliant on sail power to supplement their engines, and their designs soon evolved to include sufficiently powerful propulsion from the latter and fuel storage to eliminate sails (Saunders 1989: 195). The demands of the modernising Royal Navy led to a need to create massive new base facilities and ammunition storage capacity, seen in the continuing enlargement of Chatham Dockyard into the 1880s (MacDougall 1981: 114), and in the building of ammunition depots in the Medway at Lodge Hill, Chattenden and Upnor (MacDougall 1981: 116). The basins of Chatham and Sheerness dockyards and the soon to be provided Dover breakwaters which created a large enclosed harbour,

are further reminders of this phase of naval development (Smith 2001: 71). All have left a significant structural survivals, sometimes impressively so.

### *The land defences of London 1890s-1906*

Measures taken for defence evolved in a competition between the 'Blue Water' school arguing for basing defence on the navy which it considered better able to prevent an invasion, and the 'Bolt from the Blue' opponents who contended that strong military forces and fortification on land were vital because they believed the navy could not guarantee immunity from invasion (Moon 1968). The military influence was in the ascendant with the inception of the London Defence Scheme of the 1890s. This involved peacetime construction of preparatory, permanent focal points for a 116km line of entrenchments which, utilising techniques of concealment, were to be made along the escarpment of the North Downs when invasion threatened (Ardagh 1888). Trenches were to run from Guildford to Westerham, then to the Thames near Dartford, resuming downstream at Vange in Essex to Epping. On mobilisation, labourers were to arrive with tools and defending forces were to bring guns, small arms and stores by train to the nearest rail head. The permanent works, labelled Mobilisation Centres, were 13 ammunition/tool stores, most of which were defensible in the form of a redoubt (Smith 1975; War Office 1903). Several with a command of the country could be utilised for the mounting of light artillery. They drew upon the designs of several works of the nearly contemporary new Chatham land defences, including use of the new Twydall Profile developed there. As at Chatham, the defensive artillery was to be in dispersed positions, with close defence against infantry provided from magazine rifles and machine guns, a combination of weapons which gradually revolutionised land warfare (Smith 1985: 125-38). As well as deploying a field army between London and the coast to interdict an enemy, a powerful force was to be positioned within the area enclosed by the defences, ready to act against an advance on London. However, with recognition of the increased power and ability of the navy to prevent an invasion, the London Defence Positions were abandoned in 1906 and, as commended by the 1905 Owen Committee, there were cuts in the number of coastal batteries and guns around Britain.

The London Defence Positions were an unusual occurrence in the development of British fortification and the survival of many of the mobilisation centres represents an important historical resource. The Reigate mobilisation centre has been subjected to individual study (Smith 2000 and Beanse 2000, Smith 2014) and has been interpreted for visitors. The Box Hill and Henley Grove centres also have limited public access. In Surrey the western commons were used for military training from the mid 19th century, a tradition that still continues. A complex series of practice earthworks, forming a later 19th century redoubt have been surveyed at Hungry Hill, near Farnham, overlooking the Aldershot ranges (English 2005).

### *The 20th Century*

Interest in 20th century military sites was, in part, stimulated by Henry Will's work on pillboxes (Wills 1985, now overhauled by Osborne 2008) which led to more local and national surveys (Shepheard and Crocker 2004; Denison 2002; English Heritage 1998; English Heritage 2000a; Loopholes 1992; Lowry 1996). Over 3,300 sites have been listed in the region for the Defence of Britain Project, most of which are Second World War defensive positions.

***The First World War***

The 1904 Entente improved Franco-British relations and Germany was increasingly seen as the more likely future enemy and possible invader. With continuing confidence in the ability of the Royal Navy, the Defence Committee now considered that invasion was basically a naval problem, preventable by the fleet. Within several years, and however reasonably judged, that confidence began to be somewhat tempered following an admission that an invasion of up to 70,000 men was possible. When war with Germany came in 1914, optimism further eroded (Cab. Paper 3/3/81 1914). The remains of the First World War had been less well known than those of the Second World War despite their huge diversity (Grieves 1999; Smith 2004; Smith and Killingray 2004a) but centenary research has dramatically increased our knowledge (Smith *et. al.* 2016; Brown 2017). Sites include coastal defence batteries, defence lines, airfields (Ashworth 1990; English Heritage 2000b), seaplane and airship bases (Johnson 1999; Smith 1999), concrete sound locators (or sound mirrors are they are often called) and Prisoner of War camps (Bird 2006), amongst others. The ferries on the south coast were involved with transporting huge numbers of troops and vast amounts of supplies, in addition to the remarkable military port which was created at Richborough, in order to supply the British armies in northern France and Belgium. There were also numerous army camps in the region, often associated with practice trenches, many of which still survive on ground used as training areas such as, for example, at Chobham Common. Training facilities were important for the instruction and preparation of troops destined to fight on the Western Front and elsewhere. Such sites can often be studied from aerial photos though some limited excavation work has been done at Polegate and Seaford (M. Brown and Luke Barber *pers comm.*).

*Coastal and anti-invasion defence*

A rush to improve coastal defence was addressed by reinforcing and supplementing the existing defences of the Thames and Medway (Smith 2002: 39; Smith 2016), Dover (Burridge 2001; Smith 2016) and Newhaven (Goodwin 1985: 75). In the Thames and Medway this involved adding gun positions to existing forts and building new batteries at Grain and on Sheppey. There were others at minor harbours in East Kent but knowledge of them is superficial.

Naval defence to prevent invasion depended upon maintaining a balance of sea power and upon the generality of wise fleet deployments. There were local defence flotillas, one based on the Thames and Medway and the Dover Patrol operated from Dover Harbour, providing an important presence in the English Channel (Burridge 2001), with other naval units operating from Ramsgate. As well as this there were gun monitors stationed in various places around the coast (Smith 2001; Smith 2016).

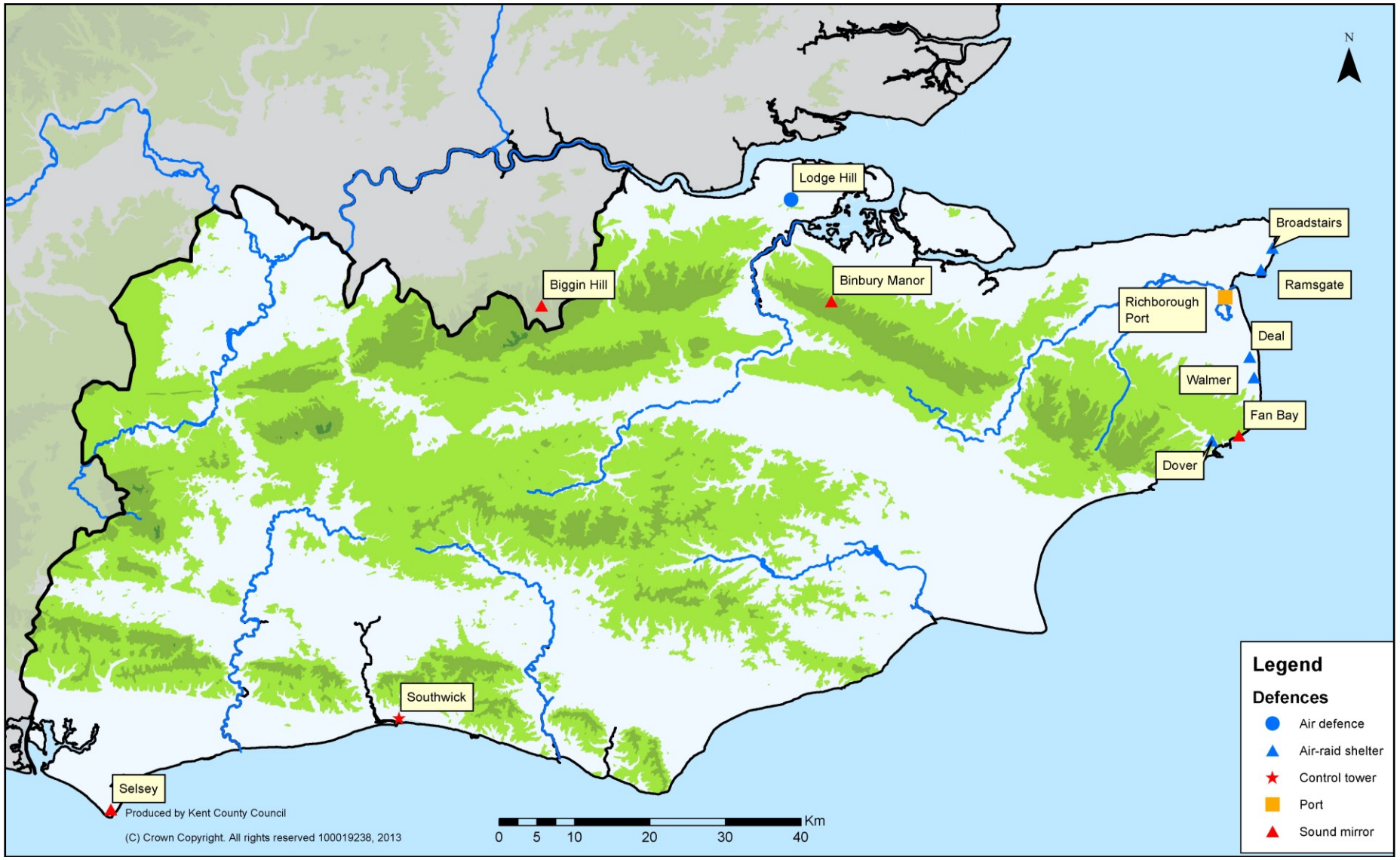


*Figure 6 First World War sites considered in the text*

During the war there was sporadic German naval firing at coastal targets in Kent. An unrealised scheme to block the English Channel at Dover with concrete gun towers to be towed out and sunk on the seabed and connected with torpedo nets is represented by one tower (built at Southwick in Sussex), now standing off the Isle of Wight (Goodwin 1985: 80-3). In an unprecedented move, the Channel was seeded with mines (Goodwin 1985: 77). Boom defences against attack by torpedo boats and submarine attack were again provided at Dover, in the Thames and the Medway as well as elsewhere, including net protection (Burridge 2001; Smith 2001; Smith 2016).

Until recently, anti-invasion defences, especially those inland to prevent an enemy advance, have been a less researched theme. We now know that the London Defence Positions, which had been discontinued just eight years before, were activated, with trenches being cut in Surrey, Kent and Essex (Smith 1985: 143-4; Morris 2009; Smith 2016, 63-105). There were remarkable and extensive fieldworks on the coast of Sheppey and elsewhere on the island, as well as between the Swale and Maidstone. These incorporated positions for artillery and even included arrangements for coastal batteries to fire inland to support the lines of fieldworks. There was another trench system around the Medway towns, reactivating the Chatham land front. This was linked by a line to the London defences. There were further systems at Chattenden and Lodge Hill, (Smith 1985: 143). An extensive system enclosed the land side of Dover (Burridge 2001) and there is evidence of a line running south-east of Canterbury to Temple Farm near Dover (Smith 2016: 88). There are remains of First World War trenches at Shorncliffe, perhaps both for training and defence, and which have been archaeologically investigated at intervals since 2013 (George 2004 et al, 31; Found 2019, pers comm). There are anecdotal suggestions of trench schemes elsewhere in Sussex (Goodwin 2007, pers comm). Trenches are suggested by cropmarks in the landscape, across Thanet, inland from Deal and at Kingston near Canterbury, but have been little investigated; some are presumed to be practice works but others potentially relate to defence or other military uses of the landscape. Facilities were engaged with the manufacture and testing of new technologies. As well as government factories for war production some were private enterprise, such as Curtis and Harvey's explosive works at Cliffe at the side of the Thames. A new proof and experimental artillery testing range was built at Yantlet Creek in 1917 (English Heritage 2014).

*Air defence*

The war also saw a new technological challenge in the form of attack from the air, whether by airships or aeroplanes. This forced a fundamental shift in the strategy of home defence and brought warfare not only to the coast but also to the interior of England, including to its general population which, from time to time, suffered death and injury from bombing, although not on the scale of the Second World War. Because of the presence of military targets and of London, the region was a particular target for bombing or over-flight. Air defence became based on concentric layers of protection radiating from London into Kent, Surrey and Essex. These consisted of anti-aircraft gun batteries, barrage balloons, searchlights, fighter interceptors at a number of airfields and ground observers. The military and naval assets around the river Medway came within this protective scheme. There were outer barriers of gun defences between Romney Marsh and Whitstable and along the East Kent coast between Folkestone and Margate (Wood 1992: 9-20; Smith 2016: 93-97). There are survivals of anti-aircraft gun batteries in the Medway area, particularly at Lodge Hill as well as

at Fort Burgoyne at Dover, and possible sites elsewhere (Smith 2001: 82). Following experimentation at Binbury Manor, several sound locators were established in East Kent, and at Biggin Hill. These, with the network of ground observers, were to detect enemy aircraft at long range and, by a process of reporting, to enable the activation of both interceptor aircraft and the anti-aircraft gun network (Smith 2001: 77; 2016: 95). One sound locator, next to a later one, has been exposed through archaeological excavation at Fan Bay, Dover. A locator at Selsey has been linked to this period (Baker 2007, pers comm). There were many airfields across the region used for interceptors and as landing grounds (over 40 of them in Kent alone). These had variously temporary and semi-permanent buildings for personnel, and for airfield services, including hangars, repair shops and garages for motor transport. They have left traces and scope for archaeological investigation. At Manston there are remains of semi-underground aircraft hangars, intended to give a certain amount of protection during an air attack but there are numerous other survivals here and elsewhere. In addition, there were airship and seaplane bases within the region for coastal and maritime patrols, perhaps with unrecognised field evidence (Osborne 2004: 111; Smith 1999). One of the airship stations at Kingsnorth near Hoo in Kent combined manufacturing with patrol activities. This has been partly archaeologically investigated (Dawkes 2017). Other stations might be traceable through the use of aerial photographs. There was also civil defence against air raids, but its extent is unclear, although shelter tunnels are known at Ramsgate, Dover, Broadstairs, Deal and Walmer (Kent County Council 2006).

Major studies of Britain's First World War defences appeared in 2015 and 2017 (Appleby 2015; Osborne 2017).

***Interwar defences***

Following the end of the war there was a dramatic down-sizing of the air force and anti-aircraft gun defence was reduced almost to vanishing-point. The absence of an identifiable enemy initially induced uncertainty about priorities for defence but the achievement of a balance of air power with France soon evolved as a politico-strategic objective (Collier 1957: 11). This led to the Steele-Bartholomew Scheme of 1923 to rebuild Britain's air defences. Recruitment of volunteer ground observers of the new Observer Corps to warn of incoming enemy aircraft began in 1925 (Wood 1992: 18). By the mid-1930s, and the re-orientation scheme, preparations focussed on Germany and the likelihood of large-scale air bombardment of Britain in a future war (Collier 1957: 28). The popular and governmental fear was of apocalyptic and saturating raids, including the use of poison gas. This was graphically predicted in the film version of HG Wells' *Things to Come* in 1936.

*Sound locators and radar*

Building on First World War experience, air defence counter-measures in the 1920s-30s, included a scheme of bowl, disc and strip concrete sound locators built along the south coast of Kent and on Sheppey (Scarth 1999). This was sophisticated acoustic science. Seven coastal locators from this period are visible at Fan Bay, Abbots Cliff, Hythe and Greatstone. All are important heritage assets. An eighth on the coast of Sheppey is badly damaged, requiring recording before loss to coastal erosion. Two lines of experimental vertical searching discs flush with the ground surface were also constructed behind the south coast in 1924/5 (Scarth 1999). However, sound location

was a technological blind alley, to be succeeded by radio direction/range finding, RADAR, seen in the long-range Chain Home stations at Dunkirk and Dover (1936-8), followed by Rye, Pevensey and Poling by 1939 (Wood and Dempster 1961: 61). Subsequently these were supplemented by the Chain Home Low system for detection of lower level targets. These radar systems have left structural evidence.

*Airfields*
Air force expansion led to an increased need for airfields (Francis 1996: 18). Expansion period airfields have been described in publication but have not reached the limits of study. The main stations in the region were at Eastchurch, Hawkinge, Biggin Hill, Detling, Manston, Tangmere and Kenley, each with varying degrees of survival. These were brought to readiness during the Munich Crisis of 1938 (Collier 1957: 63). Because of the vulnerability of airfields to bombing, thoughts were given to dispersing living accommodation to sites away from airfields but within a short travelling distance. This began to be implemented over the next year or two. Examples of such sites are to be seen in remains at Hawkinge, Detling and Gravesend.

Parallel with this was expansion of the Territorial Army, with new drill halls being provided, (Collier 1957: 30-5) typically of neo-Georgian design. Late interwar practice trenches have been suggested at Seaford Head (Baker 2007, pers comm).

*Civil Defence*
A significant but less researched topic is the introduction of civil defence from 1936 (Collier 1957: 26). This included detailed contingency planning, recruitment of volunteers and the building of an infrastructure of civil defence control centres, air raid warden posts, bases for heavy and light rescue, emergency mortuaries, decontamination centres, public and private air raid shelters as well as other provision. There were hundreds of sites and an extensive organisation, all put on stand-by during the Munich Crisis of 1938, when many public trench air raid shelters were made (Dobinson 1996a.) There is large scope for investigation and reporting.

*Anti-aircraft batteries*
From 1937 the region shared in a massive programme for the building of heavy anti-aircraft gun batteries. These were to mount more powerful guns than before and had new site layouts, improved range finding, and command and control (Dobinson 1996b: 56). Because of delays in manufacturing the guns for them, this network was not completely armed until the outbreak of war. Consequently, some batteries activated during the Munich Crisis, had to be armed with guns from the First World War (Dobinson 1996b: 59). There are surviving batteries, whether built then or later in the programme. (Dobinson 1996b: gazetteer). However, through demolitions, this is a diminishing resource. Munich Crisis defences, including the beginnings of a new searchlight network, sometimes seen as little more than an historical blip in the lead up to the outbreak of the Second World War, are deserving of greater investigation in their own right.

***The Second World War***
Compared with earlier periods, there are many more remains in the region from the Second World War. These have received a great deal more interest from the voluntary

sector and so our knowledge of them is often more advanced than for earlier periods (Smith and Killingray 2004b; Leslie and Mace 1999; Shepheard and Crocker 2004).

After the outbreak of war, the positioning of allied armies on the Continent, able to block an advance west by German forces made invasion seem unlikely. Although existing coastal defences were activated as a precautionary measure against sea raiding only limited provision of anti-invasion defence was made. However, Germany's occupation of the Low Countries and Norway, and finally the defeat and ejection of the allied armies from the French coast in the summer of 1940 brought enemy forces uncomfortably close to England. Coordination from Dover of the evacuation of the allied armies from Dunkirk and elsewhere (Operation Dynamo) and the use of Kentish and Sussex ports for disembarkation gave the region a key part in this event (Collier 1957: 111).

*Anti-invasion and coastal defences*

Following the Dunkirk evacuation, an attempt by Germany to invade seemed certain and this radically increased the tempo of home defence measures (Smith 2001: 88). Demanding continuing research are the resulting vast systems of anti-invasion defences built from 1940-1 as a response to Britain's new vulnerability. These took the form of a coastal crust of protection and layers of defence inland. The latter included extensive defensive lines, not least of which was the major GHQ Line which traversed the region, but there were others, as well - in places - smaller grid lines. Added to this, where roads that an enemy might take intersected in towns, villages and junctions, there were, increasingly, nodal points, fortresses and anti-tank islands. These defences embraced proliferations of pillboxes, anti-tank ditches, road blocks, spigot mortar positions, fougasses and some minefields (Dobinson 1996c: 14). The overall purpose of this defensive infrastructure was to act as a brake on the rapidity of an enemy advance which was to be encouraged into prepared killing zones. The risk of paratroops landing behind the coast was recognised, resulting in enhanced protection being given against such landings at airfields. Similarly, there was a threat of troops landed from gliders and aeroplanes anywhere and, in consequence, some open spaces were provided with obstructions against this. Triple lines of land defence for London radiated into North Surrey and North-west Kent (Osborne 2004).

The region's closeness to the Continent and being on the route of advance to London for an invader made its security vital. South Eastern Command, created in January 1941 by splitting Eastern Command into two, was nearly coterminous with the study region. By later 1941 dependence on linear systems of defence had reduced in favour of a mobile form of defence which the greater availability of tanks and other vehicles, artillery, trained personnel and ground attack aircraft made possible but by the end of 1942 the perceived threat of invasion had significantly diminished. Under invasion conditions, some towns were to be ruled by Triumvirates of civil, military and police representatives. Under such conditions there was also to be decentralisation of government under Regional Commissioners. One of them was headquartered at Tunbridge Wells (Collier 1957: 103). These and other similar command centres often featured underground elements, such as the Nore Command HQ below Brompton Lines, amongst others in the region (Ellis 1996). There were structures built by or for the Home Guard (Graham 1998), including underground 'hides' and related structures for Auxiliary units to act as a resistance behind enemy lines in the event of invasion (Angell 1996; Fleming 1957: 270). There were also army camps (Ogley 1995), storage depots, Prisoner of War camps, training areas, firing ranges, slit trenches (cut through a Roman temple at

Chanctonbury: Rudling 2001), searchlight positions, Observer Corps posts, military hospitals and bomb damage (as at Canterbury and Ashford to name just two places) Stevenson 2013; Ogley 1992). Loss of buildings from bombing can often be memorialised by the placement of new structures in the spaces, contrasting with the adjacent pre-war stock. The region was definitively marked with a large and varied defensive signature, becoming virtually a militarised landscape, with hundreds of sites and thousands of component defensive positions and features (Dobinson 1996c: 14, 55). Of these, pillboxes and concrete obstacle blocks are the most obvious and iconic survivals but there are many others (Brown 1995), with more ephemeral defences often quickly removed after the war (Alexander 1999; Hall 2002).Nodal points at Tonbridge and Maidstone are currently being studied (reports by P. Tritton and C. Holden forthcoming). That for Chatham is soon to begin (Smith 2019, pers comm).

Coastal defences continued to be centred on the pre-existing batteries in the Thames, Medway (Smith 2002: 41-4), Dover (Burridge 2001) and Newhaven (Goulden and Kemp 1974: 15-17). The Kent and Essex shores of the Thames were joined by anti-ship booms and earlier-provided ones were reactivated for Dover harbour. As in the Revolutionary and Napoleonic Wars however, many further emergency batteries were added along the coast, particularly to defend landing beaches (Hogg 1974: 237). As a sign of the times, many were protected with overhead canopies against strafing and bomb splinters from air attack. As in the First World War naval defences depended upon strategic British fleet deployments and local flotillas, a subject meriting greater research effort. There were also coastal minefields, on land and offshore as well as sea minefields of large size. Heavy railway guns to be used against invasion were held in various places, especially to the north of Dover but also elsewhere, from which they could be deployed according to need. Some traces of their infrastructure remains (Reed 1980). Unprecedented was the building of specialised heavy batteries just to the north of Dover and armed with guns having ranges to reach out across and to almost close the English Channel to movement of enemy shipping. These were provided with either surface or buried magazines, deep shelters and underground plotting rooms. The concentration of batteries at Dover was the largest during the war and although there have been many demolitions, these have left structural evidence, which has potential for archaeological investigation, interpretation and public access (Reed 1980), now being taken forward by the National Trust. It should be noted that Dover and other parts of the coast and hinterland were, from time to time, bombarded by German guns sited on the Continental channel coast.

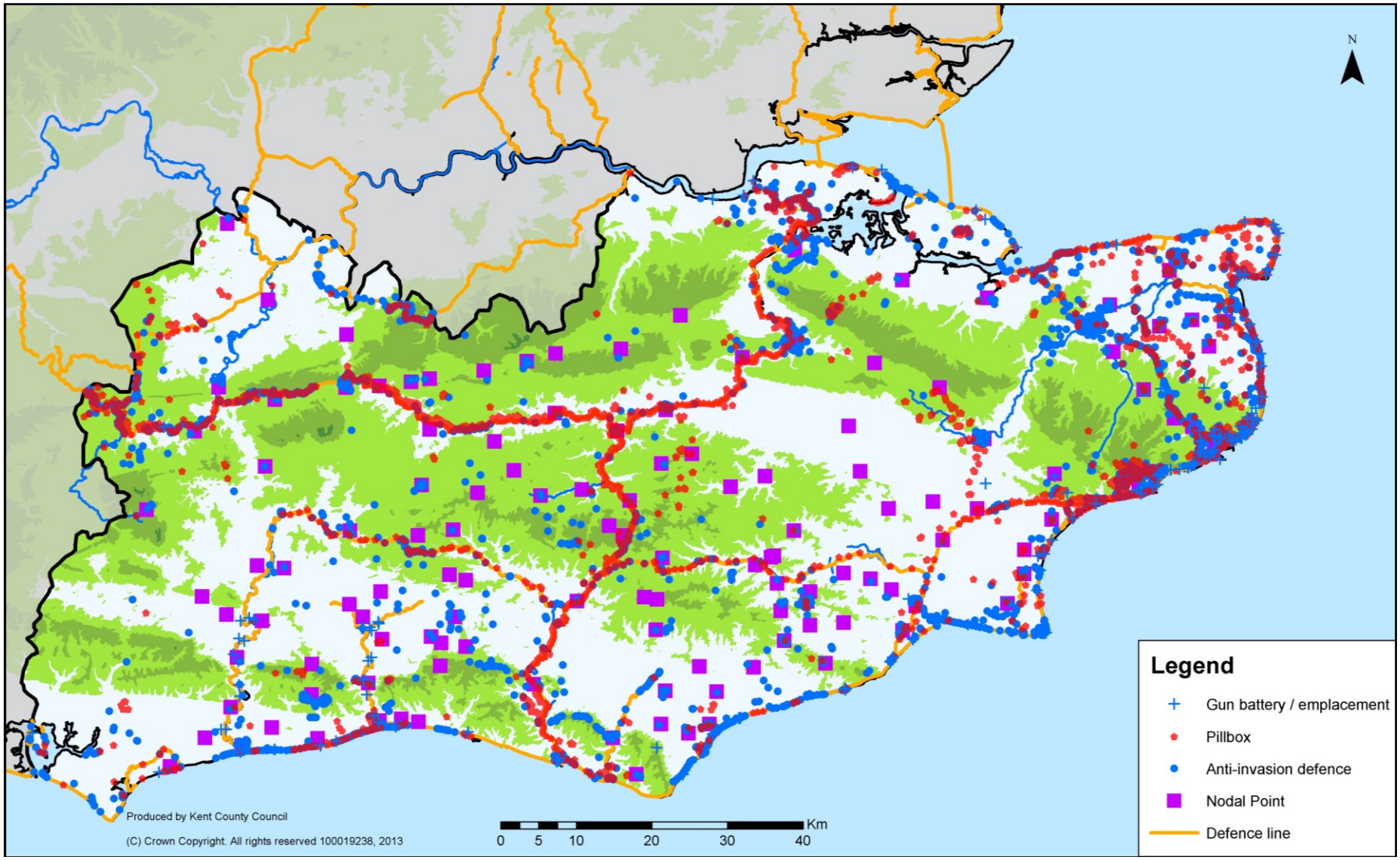


*Figure 7 Second World War anti-invasion defences in South-East England (data from Defence of Britain Project*

*Air defence*

There were serious air attacks, starting with the bombing offensive of 1940 and followed by the Baedeker revenge raids of 1942, so destructive to Canterbury and elsewhere (Collier 1957: 305-11). Although bombing in general was much greater than in the First World War and brought with it countless episodes of tragedy, it was less apocalyptic in scale than had been imagined in inter-war predictions. Air defence had to plan for the worst and, with enhancement of the networks of searchlights and barrage balloons, completion of the anti-aircraft gun battery programme progressed with vigour (Dobinson 1996b: 66) but these sites are often historically unsurveyed. Included were the innovative and partly still-surviving offshore anti-aircraft forts, both for the Army and the Navy, in the Thames estuary, of a nature replicated only in the Mersey (Turner 1994; Turner 1995; Turner and Stewart 1996). As the region was on the route to London for bombers from German occupied France and Belgium it was one of importance for the siting of interceptor airfields, notably used during the Battle of Britain, a period which saw active and sustained conflict in the air and which has left considerable traces in the archaeological record, whether elements of airfields or as scattered remains and crash sites (English Heritage 2002). Many airfields, together with landing grounds for returning damaged aircraft, were added to pre-war ones (Brooks 1993; Brooks 1998; Dobinson 1996d: 176; Humphreys 1981; Jacobs 2005; Ogley 1990; Willis and Holliss 1990). There were further radars for long-range detection of air targets and for the fire direction of coastal and anti-aircraft batteries. These came to include the Chain Home Extra-Low system (CHEL) (Dobinson 1996e: 16; Longstaff-Tyrell 1998; Martin 1999). Military and naval facilities, airfields, as well as some towns were provided with decoy sites, to distract enemy bombers (Francis 1996: 20). They had standard forms of control room but varied in site layout and features or mechanisms present (Dobinson 1996f: 6). A number of factories were camouflaged against spotting from the air and sometimes there were projectors to emit smokescreens.

*Civil defence*

Air attack threatened military and industrial assets and the population as never before. Expressing urgency and determination, civil defence (Collier 1957) benefitted from the receipt of further control centres and reserves, air raid warden posts and fire stations, gas decontamination centres, and emergency water tanks to provide supplementary supply for putting out fires caused by bombing. There were emergency stores of food and fuel. New *Blitzmerge* arrangements were introduced. These involved civil defence planning cooperation between towns and mutual assistance, linked with reinforcement by civil defence forces from outside, should this become necessary. Public shelters proliferated and thousands of individual domestic shelters were provided - predominantly the corrugated iron Anderson type which had started to be issued even before the outbreak of war, as well as the steel-frame and mesh Morrison for inside use but many concrete ones were made by, or commissioned by, householders. Some large shelter complexes were constructed for workers in industrial premises (e.g. at the Henley engineering works at Northfleet) and a variety of underground structures were either commandeered or dug-out for use as air raid shelters (e.g. Catford 2005: 3-31; Jarman 2010). Many of the shelters, whether above-ground or private types, were removed after the war and destruction of the remaining examples is still occurring, although attempts are now being made to record these before demolition (Barber

2010). Air raid shelters on school premises have, in particular, been recorded. Numerous survey reports are, for example, held by Kent County Council.

*Operation Overlord*

The region had special importance in the preparations for Operation Overlord, culminating in the landings in France from 6th June 1944 (Mallory and Ottar 1973: 200). There were camps for troops designated to take part in this operation, additional airstrips, manufacturing sites for the Mulberry Harbours used in the invasion and pipelines across the landscape to the coast to be linked with those laid on the bed of the Channel to supply fuel needed by the liberation forces (PLUTO) (Turner 2001: 9-11). The region was both an element of deception plans to convince Germany that an invasion would take place in the Calais area (Operation Fortitude) and of real arrangements for invasion through Normandy (Reymond 1994). This has left evidence, not least in concrete invasion hards, for loading of landing craft with weapons, vehicles or other supplies destined for the French coast (Dobinson 1996g: 11) but also in training structures, such as the replica section of the Atlantic Wall near Farnham (Shepheard 2002).

*The V-weapon offensive*

Following the Allied invasion of Europe, a new phase of bombing commenced, more innovative than the earlier aerial bombardment; the V-weapon campaigns of 1944-early 1945 (Collier 1957: 345). Because London was an important target for those weapons, the region was on their route, having a place both as a victim and as a defence. Under the DIVER scheme against the V1, there was a twin main defence: (a) the positioning of new anti-aircraft gun batteries (including redeployments) in barrier lines across the region, mostly in temporary positions and (b) the use of fighter interceptors. Defence was enhanced by balloon barrages and by improved radar detection as well as by air attacks on the Continental launch sites and construction infrastructure. (Dobinson 1996h). Against the V2 rocket no interdiction in its flight was possible and, again, similar bombing on the Continent was resorted to. Launching and construction sites for the V1 and V2 were gradually overrun as the Allies advanced. Important research and investigation of V-weapon impact sites and the associated countermeasures has been carried out by Colin and Sean Welch of Research Resource (V. Smith *pers comm*).

*Investigating Second World War defence sites*

The work to date on defence features of the 20th century has only begun to explore the potential of these sites. Field evidence of both standing and buried sites, profuse documentary evidence, German aerial photographs/invasion planning maps and post-war air photographs suggest there is still much more to discover. Documentary research is essential to understand how these sites functioned, as they included defensive elements no longer extant (P. Hibbs *pers comm.*). Important recent work has explored the pillboxes, anti-tank ditches and other features of that part of the GHQ Line which crossed the Hoo Peninsula from Hoo St. Werburgh to Cliffe, elements of which have received statutory protection. The variety and evolution of the triad of land, air and sea defence and of other defensive infrastructure is large. To take one example, the pillbox, although design was generally decided by the War Office and standardisation was the general aim, local commands modified the designs/construction to suit local needs and building material supply before issuing

plans to local contractors. As a result there is a variety of forms and unique local types (Osbourne 2008; Saunders 2005). The importance of oral testimonies, particularly regarding the construction and camouflage of pillboxes, the latter often long since vanished, has been demonstrated (Collyer and Rose 1999). Full archaeological survey often picks out important detail otherwise overlooked (Russell and Barber 2005) but where pillboxes have been subject to such investigation, this has often focussed on the individual structure, rather than considering it in the context of a wider defensive line or defended landscape (Found 2019, pers comm).

Not only should study be concerned with the nature and location of structures but, more widely, with the deployment of defensive forces as well as local defence tactics and strategy. Opportunities for documentary research, fieldwork and mapping are considerable. Kent County Council's Defence of Kent Project, progressively studying 20th century defences, by local authority district (Dartford, Gravesham, Medway, Canterbury having been completed and Thanet piloted) shows a possible way ahead (Smith 2010; 2011; 2012; 2018). William Foot's study of a number of stop lines and the defence of areas points to a means of studying the handling of landscapes (Foot 2002). As well as this, it would be instructive to discover how much intelligence information the Home Forces had about German intentions and planning for an invasion of Britain and the extent to which British defensive measures responded to that. In reciprocation, it should be possible to evaluate the quality of German intelligence of the region's defences.

There are also other elements to such sites which can often be overlooked. Wartime wall art and graffiti may be seen at some anti-invasion and coastal defence sites, for example the murals of Disney and other characters in the war shelters of the detached breakwater at Dover. The National Trust have carried out graffiti surveys within the St. Margarets Deep Shelter, whilst work by the Western Heights Preservation Trust has demonstrated the power of wartime graffiti as a catalyst for researching the lives of individual soldiers, including forging links with their descendants (Found 2019, pers comm). Extensive military graffiti from the later 19th and early 20th centuries may be found on the walls of the magazines of Shornemead Fort (R. Hall *pers comm* 2018). Graffiti effectively recording personal experiences of the war can be found in public and private air raid shelters (e.g. Jarman 2010).

***The Cold War and the nuclear age***

Following the end of hostilities in Europe in 1945, the military presence in the region dramatically reduced. The tensions of the ensuing Cold War, however, meant that coastal defence continued (Maurice-Jones 1959: 275; Smith 2001: 101), as did anti-aircraft gun defence (Hogg 1978: 136), with some new battery sites being built. There were retained fighter airfields as well as the construction of ROTOR radar and Ground Control Interception (GCI) stations. These were part of an evolving network of provision for long-range detection of air targets. The GCI station at Wartling is in the process of being prepared for public opening on an appointment basis. There were also new systems of communication towers and much else besides. The Home Guard was revived for a short time in the 1950s. The full history of these developments is imperfectly known. The nature of warfare in the jet and nuclear age rapidly led to these defences becoming outdated. By 1956, fixed coastal defences were discontinued, anti-invasion defence being provided by the air force and navy (Maurice-Jones 1959: 275).

Heavy anti-aircraft gun defence also became obsolete, being incapable of coping with high-flying fast attack, especially jet aircraft and guided missiles (Hogg 1978: 143). Gradually the fighter airfields in the region diminished in number and defensive air assets mainly transferred northeast to handle an air threat across the North Sea (Cocroft and Thomas 2003: 143). Moreover, the NATO alliance came to emphasise forward defence by air formations in Continental Europe. Nuclear weapons carried by jet bombers, based in East Anglia and the north-east as well as strategic missiles in submarines at sea and others to be fired from the land mass of the United States (and, for a time, from Britain itself) formed a strategic deterrent and provided a counter-strike capability (Smith 2001: 103).

Some elements of the airfields used in the region in the early part of the Cold War survive as do, in varying degrees, a number of radar installations, elements of which still survive in good condition, but detailed survey work has barely begun. One particular element of Cold War defence activity that occurred in the region was centred at Fort Halstead, Sevenoaks, which had an early key role in the UK's atomic bomb project (Cocroft and Thomas 2003: 246). Building Q14 at the fort was used from 1947 to construct the Mark 1 warhead, Britain's first nuclear weapon. The building has recently been listed (National Heritage List for England no. 1396578), with extended research having gone into the listing details regarding the history and activities that focused on the site, demonstrating the potential for improved designation processes and for the recognition of these modern but significant sites and buildings. Other nuclear activity in the region included Chatham naval base, which, for a time, was used for refuelling nuclear submarines (MacDougall 1981: 158-9). In its early years the UK Atomic Energy Authority (Chemical Division) maintained an analytical laboratory at the dockyard's former Gun Wharf (Found 2019, pers comm). A naval presence in the region was to gradually diminish after the Second World War, beginning with the cessation of activity at Dover, then at Sheerness and ending with Chatham Dockyard, the decision to close it being announced in 1981.

Starting in the later 1940s the region gained revived civil defence including, at strategic level, from 1953, a War Room at Tunbridge Wells and, having a wider remit, in 1962 a Regional Seat of Government at Dover. This was abandoned in 1984, to be succeeded by replacement premises at Crowborough (Coad 1995: 116). This period added a modest and sometimes still-remaining structural signature, such as civil defence control centres (county and local ones) and radiation monitoring posts manned by the Royal Observer Corps (Wood 1992). There were also protected premises for communications and for the continued operation of water, gas and electricity services after an attack as well as depots for emergency supplies of food. The rise of civil defence in the later 1940s, fall in near the end of 1960s and short-lived revival in the later 1970s and 80s has a special interest, showing the manner in which home defence planners struggled against the background of government under-funding, changes in thinking and financial cuts, to cope with preparing for the apocalyptic effects of an attack by not only conventional but nuclear, chemical or biological weapons (McCamley 2002). There is more to be discovered about individual civil defence structures, emergency provisioning facilities and the building and survival of private nuclear shelters. Buildings of this period are being lost, often with little or no recording. Surviving examples should be recorded before further alteration or loss. A regionally

and nationally important example of heritage conservation, refurnishing and public access is the civil defence control centre at Gravesend.

By 1990, as part of the 'peace dividend' following the end of the Cold War, the last vestiges of a civil defence infrastructure were discontinued. The Royal Observer Corps was stood down in 1991 (Campbell 1982) and, by the mid-1990s, local authorities were no longer required to maintain war plans and, instead, prepared against a range of civil contingencies. Despite continuation of several important military depots, barracks and Army Reserve Centres, in a recognisable historical sense, the last vestiges of regional-specific military, air, naval and civil defence ceased to exist.

However, the region is embraced within the generality of national preparedness against international terrorism and this has deposited some modest physical elements, producing archaeology for the future. The nature of the threat continues to evolve, embracing the potential for cyber-attack on Britain, especially of its infrastructure, by states or hostile groups. As acknowledged by the government, a range of current and possible future regional and global tensions, including signs of a revived Cold War with Russia, and continuing international terrorism, may yet produce threats to the United Kingdom which could, on whatever scale of probability, include nuclear, radiological, chemical and biological attack.

## Research Agenda

From the findings in the resource assessment it is evident that there are many under-explored and unexplored themes demanding attention. Some 81 research-need signposts have been identified. These are grouped together below under the section headings as they appear in the assessment.

### *Introduction*

The traditional focus of defence studies –fortifications and guns – has broadened considerably to make defence more holistic in its meaning, value and future for research. The general themes for exploration embrace:

- Geographical – (a) changes to coastlines and the extent to which these influenced defence (including within this the loss of sites through erosion and the redundancy of others through coastal accretion) and (b) the use of landscape for defence and the effects on landscapes and urban development of defensive systems, training areas and camps.
- Strategic and organisational – (a) evolution of defence as a relationship between fortifications, armies, the fleet, later the air force, and other elements of defence and (b) the extent to which defences were anticipatory and instruments of the theory of deterrence as well as reactive to imminent threats, when, where and why.
- Political – linked with this, a study of the political pressures and influences on the evolution of defence, including tensions between naval and military lobbyists.

- Influences on design – the relative influences of the design of fortifications and defensive systems from Continental and other external sources, versus indigenous innovation.
- Transport - consideration of the evolution of the methods of transport for defence and for the movement of troops and their supplies within the region.
- Science, manufacturing and the economy – the influence of the interaction of science, technology, industry, manufacturing, supply and victualling of the army and navy on the development of the defensive infrastructure of the region and its economy.
- People and communities – (a) the socio-economic effects on communities of the presence of fortifications and barracks (b) the lives and living conditions of soldiers, wives and families where present, as well as their relationships with the world around them (c) the effects of war on people living in the region and (d) the re-use of military buildings and establishments after periods of war, for example at hutted camps to provide accommodation for the homeless after the Second World War.
- Barracks and garrisons - Across all periods there is important scope to learn more about (a) the evolution of barrack designs, whether in forts or outside them (b) the supporting infrastructure which barracks contained for military activity (c) the place and nature of temporary as well as permanent barracks and camps (d) the effects of the 19th century barrack reforms and (d) the supply chain to barracks and garrisons – local versus official sources.
- Personal diaries – for all periods seek them where they may be found and evaluate their contents for what they tell us about the defences.
- Archaeological investigation – (a) where archaeological investigation/survey might address questions unanswerable by other means (b) where new information might be revealed for sites for which there is good documentation (c) where this might provide supplementary diagnostic information or (d) where this might preserve threatened sites in the record.
- Aerial surveys and prospection – (a) use of official 1946 and other aerial photographs + LIDAR to map 20th century defensive infrastructure (b) application of geophysics to locate buried sites.
- Statutory protection and heritage tourism – (a) the need for further statutory protection for sites and (b) strategising the possibilities for interpreting and presenting the region's defences to its communities and to visitors as part of a heritage tourism initiative.

Specific themes are:

## *The beginning of the Age of Gunpowder*

- Better understand the role and extent of the use of firearms in the region's defence during the 14th/15th centuries. How many castles and towns had them, including those without any signature of gun ports? Particularly with reference to Rochester and Dover.
- Explore the question of the extent to which at some castles, gunports might have been as much for martial display as for defence.

- Consider the potential for archaeological excavation and other study to resolve some historical questions – e.g. the structure, detailed design and evolution of Queenborough Castle and references to the movement of guns to Lydd and other coastal areas (Smith 2001: 15).
- Better establish the extent of planning for anti-invasion defence and the development and deployment of early-warning systems for raid or invasion, both on land (e.g. fire beacons) and at sea (e.g. deployment of pinnaces and other vessels for advanced sea observation). Also, consider the potential division between public and private provision of defence or warning systems.

### *The new age of long-range artillery defence*

- Better understand the changing balance of public/private provision of defence, e.g. in relation to the smaller harbours.
- Establish the degree of continuation of firearms provision in castles and town walls into the 16th century.
- Research the breadth of warfare and design experience of the devisors of the new fortifications.
- Discover the interaction of gun and gunpowder manufacture in the region with supply to fortifications.
- Determine whether the connecting banks and bulwarks between Walmer and Deal Castles could be investigated archaeologically.
- Research and evaluate the imperfectly known defences of Dover, Sheppey, Grain and those on the coast of Sussex.

### *Continuing defensive measures and the emergence of the Spanish threat*

- Establish a clearer understanding of the coast defence infrastructure during the first half of Elizabeth's reign.
- Establish a fuller understanding of the nature and placement of defence in the region during the Spanish Armada, of which only part is presently known. Specifically, the nature of defences associated with field army camps, such as at West Tilbury (Cruden 1843: 239).

### *The 17th century – the Stuarts, Civil War and the Dutch Threat*

- Determine the history of early fortifications dating from this period, including the Baye and Warham batteries then existing downstream of Upnor Castle in the Medway, perhaps established as early as 1603 (Saunders 1967: 9).
- Establish what fortification work and military/defensive infrastructure existed across the region during the Civil War. Within that, assess the earthwork at Squerryes Court.

- Research and establish the sites and systems of defence generally in the 17th century, to fill gaps in knowledge. Within that, those of the Dutch Raid in 1667 and the post-raid defences of the Medway.

### *The 18th century – reaction to Continental wars and major new schemes of fortification*

- Establish the nature, longevity, activity and function of the various military training camps across the region from the pre-French Revolutionary War onwards.
- Better establish the sequence and strategy of defences built at the smaller harbours, in particular in relation to the George III Act of 1761.
- Better establish the full extent of the 1770s fieldworks on the Western Heights at Dover.
- Establish the evolution, extent and nature of the new and enlarged landward defences at Sheerness.
- Explore the potential to excavate a section of the original mid-18th century fieldworks of the Great Lines at Chatham, thought to exist under the Spur Battery of Fort Amherst.

### *The French Revolutionary and Napoleonic Wars (1793-1815)*

- Investigate the successive defensive stop-lines behind the region's coasts to establish location, related infrastructure of supply and any surviving archaeology, with particular importance placed upon the pre-Martello and Royal Military Canal situation and also on undated apparently temporary sites.
- Seek evidence of innovation in the design and construction of defences during the French wars.
- Establish the full extent of barrack provision during the French Wars and, with other documentation, seek to better understand and present the life of the common soldier during this period.
- Investigate and map the extent, chronology, type and locations of the elements of the signalling systems adopted during this period, showing the extent of survival and the potential for archaeological excavation.
- Draw together all the available evidence for the structures which constituted the defences during the French wars and their support infrastructure of barracks and set them in their political, chronological and other contexts.

### *After the Napoleonic Wars and before the Royal Commission*

- Investigate whether the invasion scares of 1825 and 1830 gave rise to any defence construction.

- Discover whether defences were provided at the new Dover harbour, begun in 1847.
- Evaluate the known construction of new pre-Royal Commission defence sites along the Kentish and Sussex coasts and upgrading of existing ones. These have been identified and studied on an individual basis but we need to discover how far they formed elements of a planned and related scheme of defence.

### *The forts of the Royal Commission*

- Set the defences of this distinct evolution of the industrial age in their wider European, technological and architectural context.
- Establish the progress of the move to rifled muzzle-loading in the region's defences, delays in provision and the extent to which smooth-bore technology continued to be used and why.
- Consider the possibilities for further detailed site survey and report, building upon the RCHME surveys (e.g. Brown et al 1989).

### *The Chatham Ring Fortress*

- Historically survey and report upon the surviving forts and redoubts plus incorporate any insights into the planned related outworks and associated land usage

### *The continuing march of technology*

- Establish an understanding of the development of the harbour of refuge at Dover and of the defences of its breakwaters.
- Research and report the understudied transitional period for the region of the move from rifled muzzle-loading to breech-loading and the related infrastructure of new fire control and other attendant technologies.

### *The land defences of London*

- Extend and complete earlier study of the mobilisation centres.
- Place the London defences in their continental context, specifically establish how they compared or contrasted with other contemporary schemes.
- Determine the extent to which the transport and labour resource infrastructure was prepared in peacetime to ensure the activation of the defences.

### *The First World War*

- Establish a fuller understanding of the measures for coastal defence and, building upon recent research, of inland stop lines.

- Establish and map the distribution of air defence sites, including sound locators, anti-aircraft batteries, fighter airfields and other protective measures to better understand the organisation of this new form of defence.
- Gain a fuller understanding of experimental and early aviation sites (e.g. on Sheppey and Grain) and of the manufacturing of airships and their operational use.
- Investigate the little-known provision for civil defence.
- Explore the infrastructure of barracks, camp sites and training areas as well as the effects of defensive measures on the landscape and agriculture, with specific reference to the trench networks.
- Research the military port created at Richborough.

### *Interwar defences*

- Seek and record suspected archaeological evidence for vertically searching sound mirrors in the Kent coastal hinterland.
- Evaluate the generality of the evolution of air defence in the region during the interwar period.
- Establish the evolution of air defence command and control system from the days of early warning based on sound location to radar.
- Investigate the provision of civil defence and its structures.
- Determine the extent of the building of new drill halls in the region as part of the expansion of the Territorial Army.
- Gain a comprehensive understanding of the measures, military and civil, taken during the Munich Crisis of 1938.

### *The Second World War*

- Fully research the region's role in Operation Dynamo.
- Embrace Second World War defence within an extension of the approach and methodology utilised in the Defence of Kent Project for the location, identification and recording of all categories of 20$^{th}$ century home defences to the region and, by doing so, establish the wider pattern of the militarised landscape.
- As part of the above, collect personal contemporary recollections of the defences before eyewitnesses are no longer available.
- Investigate the extent to which decision making for the construction of Second World War defences was delegated to local levels, which contractors were used and the differences in nature and quality of their work.
- Building on existing research, establish the full extent and intended use of Home Guard Auxiliary units and their hides.
- List and collate data for the main, and minor, military airfields and temporary landing grounds many of which are being built on.
- Investigate the approach to naval defence.
- Establish the anatomy, distribution and development of the various radar detection systems and of beam-bending provision against enemy bombers.

- Extending earlier research and publication, learn more about the details of the deception schemes to distract enemy bombers away from airfields, harbours and some towns.
- Explore the arrangements for provision of railway guns and their role in defence.
- Determine the accuracy of German intelligence of British defences and British perception of German plans.
- Establish the chronology and pattern of the civil defence infrastructure.
- Consider the issues relating to aircraft crash sites (with or without war grave implications) and V-weapon impact locations. These need to be protected and subjected to proper excavation and recording. The standard of past recoveries has varied and there are continuing concerns relating to the conservation of this archaeological resource.
- Establish provision in the region for Operation Overlord and, more fully, for Operation Fortitude, the deception plan.
- Understand all aspects of the Operation Diver anti-V-weapon defence scheme and find the extent of site survival.

### *The Cold War*

- Determine the full scope of post-Second World War air defence in the region, including protection by anti-aircraft guns, and by fighter interceptors, as well as the extent of radar and command and control structures, especially noting the extent of survivals.
- Build on earlier research of the network of Royal Observer Corps posts for spotting enemy aircraft and of the successor underground posts for monitoring the pattern of nuclear bursts and the spread of radiation, to find out more about them and how they linked with the activities of Group and other controls.
- Research the scope of coastal defence and of its demise in the region, together with the distribution and function of home forces against raids by Russian Special Forces and invasion.
- Explore the key role of the Research and Development Establishment at Fort Halstead, including activities relating to the British nuclear weapons programme.
- Establish the scope of provision for Cold War civil defence and the extent of the survival of sites as well as collecting and evaluating relevant personal recollections.
- Determine the pattern and intended use of emergency food depots.

## Bibliography

Adams 1588. *Thamesis Descriptio, Anno 1588*. BM K6 17.

Aldsworth, F 1981. 'A description of the mid-19th- century forts at Littlehampton and Shoreham, West Sussex' *Sussex Arch. Collect.* 119, 181-194.

Alexander, C 1999. *Ironside's line: the definitive guide to the General Headquarters Line.* Historic Military Press.

Allen Brown, R 1976. *English Castles.* London.

Angell, S 1996. *The Secret Sussex Resistance,* Midhurst: Middleton Press.

Anon 2003. Interim reports on recent work carried out by the Canterbury Archaeological Trust, *Arch. Cant.* CXXIII, 291-307.
Appleby et al 2015. *The Home Front in Britain in 1914-18, An Archaeological Handbook, CBA.*
Ardagh, JC 1888. *Proposals for the Defence of London.* National Archives. WO33/48, A116 and A138.
Ashworth, C 1990. *Action Stations 9: the military airfields of the central and south-east.* Wellingborough: Patrick Stephens Ltd.
Ballinger, J. 2000. *An Archaeological Resource Assessment of Modern Northamptonshire (1750 onward).* East Midlands Archaeological Research Framework. (https://www2.le.ac.uk/services/ulas/images/east-mid-research-framework/44nhmod.pdf)
Barber, L 2010. 'The air-raid shelter at St Mary's CE School, Climping, West Sussex' *Sussex Arch. Collect.* 148, 257-261.
Beanse, A 2000. *The London Mobilisation Centres.* Palmerston Forts Society.
Biddle, M 1982a. *The Castles in the Downs*. History of King's Works. IV (Part II). HMSO, 455-65.
Biddle, M 1982b. *Camber Castle, Sussex*. History of the King's Works. IV (Part II). HMSO, 415-47.
Biddle, M 1982c. *Sandgate Castle, Kent.* History of the King's Works. IV (Part II). HMSO, 569-87.
Biddle, M and Summerson, J 1982. *Dover Harbour.* History of the King's Works. IV (Part II). HMSO, 729-68.
Biddle, M, Hiller, J, Scott, I and Streeten, A 2001. *Henry VIII's Coastal Artillery Fort at Camber Castle, Rye, East Sussex.* OAU/EH.
Bird, D 2006. *Surrey Archaeological Research Framework 2006.* Surrey County Council.
Bloomfield, P 1987. *Kent and the Napoleonic Wars*. Gloucester.
Boynton, L 1967. *The Elizabethan Militia, 1558-1638*. London.
Brooks, R 1993. *Sussex Airfields in the Second World War,* Newbury: Countryside Books.
Brooks, R 1998. *Kent Airfields in the Second World War,* Newbury: Countryside Books.
Brown, M 2017, *First World War Fieldworks in England,* Historic England.
Brown, M, Pattison, P and Williams, A 1989. *Coastal Artillery Fortifications on the Isle of Grain, Kent.* RCHME.
Brown, I and Lowry, B 1995. *20th Century Defences in Britain: an introductory guide.* CBA.
Brown, M 2003. 'War and Rumour of War: the defence of Sussex 1530-1990' in Rudling, D (ed.) *The Archaeology of Sussex to AD 2000*: 191-202.
Burridge, D 1987. *The Dover Turret.* Ramsgate.
Burridge, D 1997. *20th century Defences in Kent.* London.
Burridge, D 2001. *Defending the Gateway*. Dover.
Butler, C 2007. *East Sussex Under Attack. Anti-Invasion sites 1500-1990.* Tempus: Stroud
Butler, C 2008. *West Sussex Under Attack. Anti-Invasion sites 1500-1990.* Tempus: Stroud.
Cab3/3/81.1914. The National Archives.
Campbell, D 1982. *War Plan UK.* London.
Catford, N 2005. *The Ramsgate Tunnels.* Ramsgate.
Childs, D 2009. *Tudor Sea Power,* Barnsley.
Clements, WH 1999. *Towers of Strength.* Barnsley.
Coad, J 1995. *Dover Castle.* English Heritage: London.
Coad, J and Lewis, P 1982. The Later Fortifications of Dover. *Post Medieval Archaeology, 16,* 141-200.
Coad, J 2017. *Upnor Castle,* English Heritage: London.
Cocroft, WD and Thomas, RJC 2003. *Cold War – Building for Nuclear Confrontation 1946-1989.* EH.
Collier, B 1957. *The Defence of the United Kingdom.* HMSO.
Collyer, G and Rose, D 1999. *Guildford, the war years.* Breedon Books.
Colvin, HM and Summerson, J 1982a. *The Thames Estuary.* History of the King's Works. IV (Part II). HMSO, 602-6.

Colvin, HM and Summerson, J 1982b. *The River Medway.* History of the King's Works. IV (Part II). HMSO, 477-82.
Coulson, C 1993. Specimens of Freedom to Crenellate by Licence. *Fortress.* 18, 3-15
Crowdy, R undated. *Medway's Island Forts.* Medway Military Research Group.
Cruden, RP 1843. *The History of the Town of Gravesend*. London and Gravesend.
Dawkes, G 2017. *Between Thames and Medway: archaeological excavations on the Hoo Peninsula and its environs*. Spoilheap Monograph 13.
Denison, S 2002. 'Fortress Britain' *British Archaeology* 65 (June 2002), 8-11.
Dobinson, CS 1996a. *Twentieth Century Fortifications in England, VIII. Civil Defence in WW II*. CBA.
Dobinson, CS 1996b. *Twentieth Century Fortifications in England, **I.1**. Anti-aircraft Artillery 1914-46.* CBA.
Dobinson, CS 1996c. *Twentieth Century Fortifications in England, III. Anti-invasion defences of WW II*. CBA.
Dobinson, CS 1996d. *Twentieth Century Fortifications in England, IX.1. Airfield Themes.* CBA.
Dobinson, CS 1996e. *Twentieth Century Fortifications in England, VII.1. Acoustics and radar.* CBA.
Dobinson, CS 1996f. *Twentieth Century Fortifications in England, III. Bombing Decoys of WW II.* CBA.
Dobinson, CS 1996g. *Twentieth Century Fortifications in England, V, Operation Overlord.* CBA.
Dobinson, CS 1996h. *Twentieth Century Fortifications in England, IV, Operation Diver*. CBA.
Dobinson, CS 2000. *Fields of Deception,* London: Methuen Publishing Ltd.
Dobinson, CS 2001. *AA Command,* London: Methuen Publishing Ltd.
Douet, J 1998. *British Barracks 1600-1914, Their Architecture and Role in Society*. English Heritage.
Duffy, C 1979. *Siege Warfare.* London.
Ellis, G 1996. *The Secret Tunnels of South Heighton*, Seaford: S.B. Publications.
English, J 2005. 'Survey of a post-medieval 'squatter' occupation site and 19th- century military earthworks at Hungry Hill, Upper Hale, near Farnham' *Surrey Arch. Coll.* 92, 245-253.
English Heritage 1998. *Monuments of war: the evaluation, recording and management of 20th- century military sites.* English Heritage.
English Heritage 2000a. *Twentieth-century military sites.* English Heritage.
English Heritage 2000b. *Thematic Survey of Military Aviation Sites and Structures.* English Heritage.
English Heritage 2002. *Military Aircraft Crash Sites: Archaeological guidance on their significance and future management*. English Heritage
English Heritage 2014 Isle of Grain, Hoo Peninsula, Kent: Historic Area Assessment. English Heritage.
Fleming, P 1957. *Invasion 1940.* London.
Firth, JC 1921. *Dover and the Great War.* Dover.
Foard, G 1995. *Naseby: The Decisive Campaign.* Whitstable
Foot, W 2002. *Defence Areas – a national study of Second World War anti-invasion landscapes in England.* CBA/EH.
Foot, W 2006a. *Beaches, fields, streets and hills: the anti-invasion landscapes of England.* CBA Res. Rep. 144. York: CBA.
Foot, W 2006b. *The Battlefields That Nearly Were.* Stroud: Tempus.*ches, fields, streets and hills: the anti-invasion landscapes of England.* CBA Res. Rep. 144. York: CBA.
Francis, P 1996. *British Military Airfield Architecture.* Sparkford.
George, M and George, M 2004. *Coast of Conflict: The Story of the South Kent Coast.* Seaford.
Glover, R 1973. *Britain at Bay.* Letchworth.
Goodwin, J 1985. *The Military Defence of West Sussex*. Middleton Press: Midhurst.

Goodwin, J 1994. *Fortification of the South Coast: The Pevensey, Eastbourne and Newhaven Defences 1750-1945.* Worhing: JJ Publications.
Goodwin, J 2000. *Military signals from the South Coast.* Midhurst.
Goulden, R J and Kemp, A 1974. *Newhaven and Seaford Coastal Fortifications.* Heathfield.
Graham, D 1998. 'Excavations at Farnham Park' *Surrey A.S. Bulletin* 322, 1-2.
Greatorex, C 1995. An Archaeological Investigation of the Royal Military Canal, Near Ham Street, *Arch. Cant.* CXV, 231-237.
Grieves, K 1999. 'Sussex in the First World War' in K. Leslie and B. Short (eds.), 116-117.
Gulvin, KR undated. *The Napoleonic Defences of Rochester and Chatham.*
Gulvin, K 2000. *The Medway Forts.* Chatham
Guy, J 1980. *Kent Castles*. Rainham.
Hale, J 1982. *Defence of the Realm 1485-1558.* History of the King's Works. IV (part II). HMSO, 367-401.
Hall, A 2002. 'A Second World War anti-tank ditch at Seale' *Surrey A.A. Bulletin* 359, 1-2.
Harrington, P 2003. *English Civil War Fortification 1642-51*. Oxford.
Hogg, I 1974. *Coast Defences of England and Wales 1856-1956.* Newton Abbot.
Hogg, I 1978. *Anti-aircraft.* London.
Holden, C 2017. *Kent – Britain's Frontline County.* Stroud.
Holden, C 2018. *Chatham's Military Heritage.* Stroud.
Howard, F 1979. *Sailing Ships of War, 1400-1860.* Greenwich.
Howe, T, Jackson, G and Maloney, C 2005. 'Archaeology in Surrey 2004' *Surrey Arch. Coll.* 92, 275-295.
Hudson, A 1986. 'Napoleonic Barracks in Sussex' *Sussex Arch. Coll.* 124, 267-268.
Hughes, DT 2002. *Sheerness – Naval Dockyard and Garrison.* Strood.
Hughes, Q 1991. *Military Architecture: the art of defence from earliest times to the Atlantic Wall.* Liphook: Beaufort.
Humphreys, R 1981 (reprinted 1992). *Hawkinge 1912-1961.* Rainham: Meresborough Books.
Jacobs, P 2005. *Airfields of 11 Group,* Barnsley: Pen and Sword.
James, HA 1967. *The Dutch in the Medway.* Chatham.
James, R 1997. *An Archaeological investigation at the Gun Garden, Rye, East Sussex.* Unpub. Archaeology South-East Report 658.
Jarman, C 2010. *Site of the former Ellington Girls' School, Ellington Place, Ramsgate, Kent: Air raid shelter survey, documentary study and graffiti survey report*. Unpublished Canterbury Archaeological Trust report No. 2010/64
Johnson, C 1999. *An Archaeological Post-Excavation Assessment of Damhead Creek, Kingsnorth Power Station and Associated Works, Hoo St Werburgh, Kent.* Unpublished Archaeology South-East Report No. 1001.
Kendall, P 2007/2010. *Defending the Dockyard: The Story of the Chatham Lines*. Unpublished report.
Kendall, P 2012. *The Royal Engineers at Chatham, 1750-2012.* English Heritage.
Kendall, P and Holman J. forthcoming. *Lower Lines – Chatham*. Historic England/Canterbury Archaeological Trust report
Kent County Council 2006. Unpublished research in the archive of the Defence of Kent Project.
Kenyon, JR 1977. Early Gunports: a gazetteer. *Fort.* 4, 4-13.
Kitchen, F 1986. 'The Ghastly War-Flame: Fire Beacons in Sussex until the mid 17th Century' *Sussex Arch. Coll.* 124, 179-91.
Lake, J 2000. *Twentieth century military sites.* English Heritage.
Lawson, T 2004a. The Cinque Ports in T Lawson and D Killingray (eds) *An Historical Atlas of Kent*. Phillimore: Chichester,52
Lawson, T 2004b. 'Maritime Kent 1500-1700' in T Lawson and D Killingray (eds) *An Historical Atlas of Kent.* Phillimore: Chichester, 91-91.
Leslie, K and Mace, M 1999. 'Sussex Defences in the Second World War' in K Leslie and B Short (eds.), 118-119.

Lloyd, EM 1883. On the Forts of Today. *RUSI Journal*. XXVI, 164-79.
Longstaff-Tyrell, P 1998. *A Sussex Sunset: RAF Pevensey and RAF Wartling 1938-1964,* Polegate: Gote House Publishing.
Longstaff-Tyrell, P 1999. *Tyrell's List,* Polegate: Gote House Publishing.
Longstaff-Tyrell, P 2000. *Front-Line Sussex,* Stroud: Sutton Publishing Ltd.
Longstaff-Tyrell, P 2002. *Barracks to Bunkers,* Stroud: Sutton Publishing Ltd.
*Loopholes* 1992: Newsletter of the Pillbox Study Group.
Lowry, B 1996. *20th Century Defences in Britain. An Introductory Guide.* CBA Practical Handbook No 12.
MacDougall, P 1980. *The Isle of Grain Defences*. Kent Defence Research Group, Grain.
MacDougall, P 1981. *The Chatham Dockyard Story*. Rochester.
Mace, M 1996. *Frontline Sussex: The Defence Lines of West Sussex,* Storrington: Historic Military Press.
Mace, M 1997. *Sussex Wartime Relics and Memorials,* Storrington: Historic Military Press.
Mallory, K and Ottar, A 1973. *Architecture of Aggression.* London.
Margary, I 1965. Military Field Kitchens of the 18th century, *Sussex Arch. Coll.* 103, 60-66.
Martin, R 1999. *Report on Buildings at Newhaven Fort,* Unpublished report.
Martin, C and Parker, G 1988. *The Spanish Armada.* London.
Maurice-Jones, KW 1959. *The History of Coast Artillery in the British Army.* London.
McCamley, NJ 2002. *Cold War Secret Nuclear Bunkers*. Barnsley.
Moon, HR 1968. *The Invasion of the United Kingdom.* Phd thesis. University of London.
Morley, B 1976. *Henry VII and the Development of Coastal Defence.* HMSO.
Morris, R 2009. *Diaries and letters of Francis Lloyd.* Pen and Sword.
Ogley, B 1990. *Biggin on the Bump,* Westerham: Froglets Publications.
Ogley, B 1992. *Doodlebugs and Rockets,* Westerham: Froglets Publications.
Ogley, R 1995. *Surrey at War 1939-1945.*
O'Neil, BH St. John 1960. *Castles and Cannon.* Oxford.
Osborne, M 2004. *Defending Britain*. Stroud.
Osborne, M 2008. *Pillboxes of Britain and Ireland.* Stroud: Tempus.
Osborne, M 2017. *If the Kaiser Comes,* Fonthill.
Palmer, M. 2004. The archaeology of industrialisation: towards a research agenda, in Cotton, J, Crocker, G and Graham, A (eds) 2004. Aspects of archaeology and history in Surrey: towards a research framework for the county: 199-212.
Parker, G 1988. *The Military Revolution and the Rise of the West, 1500-1800.* Cambridge.
Pattison, P 2018. *Deal Castle.* English Heritage: London.
Reed, J 1980. The Cross Channel Guns. *After the Battle.* 29.
Reymond, J 1994. *D-Day Fortitude South*. KCC.
Rootes, A 1980. *Front Line County.* London.
Royal Engineers 1907. *Report of a Preliminary Siege Staff Ride held at Chatham, 6-10 May 1907 and subsequent siege operations held at Chatham, July and August, 1907.* RE Library.
Rudling, D 2001. 'Chanctonbury Ring revisited: the excavations of 1988-91' *Sussex Arch. Coll.* 139, 75-121.
Rule, M 1983. *The Mary Rose.* Leicester.
Russell, J and Barber, L 2005. *Pett Levels Pillbox, Rye Harbour, Rye, East Sussex.* Archaeology South-East unpublished client report.
Saunders, A 1960. Tilbury Fort and the Development of Artillery Fortification in the Thames Estuary. *A.J.* XL, 152-74.
Saunders, A 1966, Hampshire Coastal Defence since the Introduction of Artillery. *Arch. Journ*. CXXIII, 136-71.
Saunders, A 1967. *Upnor Castle.* HMSO.
Saunders, A 1989. *Fortress Britain.* Oxford: Oxbow.
Saunders, A 1997. *Channel Defences*. London: Batsford/English Heritage.
Saunders, I 2005. *Pillboxes: Images of an Unfought Battle,* Lightning Sourc UK Ltd.

Saunders, A and Smith, VTC 2001. *Kent's Defence Heritage.* KCC: Maidstone.
Scarth, RN 1999. *Echoes from the Sky.* Hythe.
Shepheard, C 2002. 'A Sea Wall in Surrey? An explanation of some wartime activities on Hankley Common near Farnham' *Surrey Hist.* 6.4, 221-3.
Shepheard, C and Crocker, A 2004. Second World War defences in Surrey, in Cotton, J, Crocker, G and Graham, A (eds) 2004. Aspects of archaeology and history in Surrey: towards a research framework for the county: 245-253.
Smith, VTC 1974. 'The Artillery Defences at Gravesend'. *Archaeologia Cantiana.* LXXXIX. 141-68.
Smith, VTC 1975. 'The London Mobilisation Centres' *London Archaeologist* II, 244-248.
Smith, VTC 1978. 'Chatham Siege Operations in 1907'*. Fort* 5, 87-93.
Smith, VTC 1980. 'The Milton Blockhouse, Gravesend: Research and Excavation'. *Arch. Cant.* XCVI, 341-61.
Smith, VTC 1985. 'Chatham and London: The Changing Face of English Land Fortification, 1870-1918'*. Post Medieval Archaeology.* 19, 105-49.
Smith, VTC 1993. 'Cockham Wood Fort'*. Arch. Cant.* CXII, 55-75.
Smith, VTC 1994. 'Trinity Fort and the defences of the Second Anglo-Dutch War at Gravesend in 1667'. *Arch. Cant.* CXIV, 39-50.
Smith, VTC 1995. 'The Royal Artillery Barracks at Northfleet during the Napoleonic Wars', *Arch. Cant.* CXV, 443-452.
Smith, VTC 1996. 'The rear defence walls of New Tavern Fort, Gravesend, 1795', *Arch. Cant.* CXVI, 283-292.
Smith, VTC 1998. *New Tavern Fort.* The New Tavern Fort Project.
Smith, VTC 1999. The Site of the Former Naval Airship Station at Kingsnorth, Near Hoo St. Werburgh, Kent. Unpub. Report for Archaeology South-East Pro. No. 1001.
Smith, VTC 2000. *Reigate Fort – a report to the National Trust.* National Trust.
Smith, VTC 2001. *Front-Line Kent.* KCC.
Smith, VTC 2002. *Defending London's River*. Northfleet.
Smith, VTC 2010. 'Kent's Twentieth Century Military and Civil Defences: Part 1 – Thameside', *Arch. Cant.* CXXX, 1-33.
Smith, VTC 2011. 'Kent's Twentieth Century Military and Civil Defences: Part 2 – Medway', *Arch. Cant.* CXXXI, 159-195.
Smith, VTC 2012. 'Kent's Twentieth Century Military and Civil Defences: Part 3 – Canterbury', *Arch. Cant.* CXXXII, 153-188.
Smith, VTC 2014. 'Defence Against Invasion: Reigate Fort'. *Surrey Archaeological Collections,* 98, 103-123.
Smith, VTC 2016. 'If the Kaiser should come: Defending Kent during the Great War', *Arch. Cant*. CXXXVII, 63-105.
Smith, VTC 2018. 'Thanet's Defences in the Twentieth Century', *Arch. Cant.* CXXXIX, 318-321.
Smith, VTC 2004. 'Defence and Fortification 1700-1914' in T Lawson and D Killingray (eds) *An Historical Atlas of Kent,* Kent Archaeological Society, 136-139.
Smith, VTC and Kelsey, P 1996. *The Lines of Communication: The Civil War Defences of London* in Porter, S. (ed) *London and the Civil War*. Macmillan Press Limited: London.
Smith, VTC and Killingray, D 2004a. 'Kent and the First World War' in T Lawson and D Killingray (eds) *An Historical Atlas of Kent,* 140-141.
Smith, VTC and Killingray, D 2004b. 'Kent and the Second World War' in T Lawson and D Killingray (eds) *An Historical Atlas of Kent,* 142-143.
Stevenson, J 2013. *Living by the Sword: The Archaeology of Brisley Farm, Ashford, Kent* Archaeology South-East SpoilHeap Monograph Series
Sutcliffe, S 1972 *Martello Towers.* Newton Abbot.
Telling, R 1997 *English Martello Towers: A concise guide*, Beckenham. CST Books
Turner, F 1994 *The Maunsell Sea Forts. Part One: The World War Two Naval Sea Forts of the Thames and Mersey Estuaries,* Gravesend: F. R. Turner.

Turner, F 1995 *The Maunsell Sea Forts. Part Two: The World War Two Army Sea Forts of the Thames and Mersey Estuaries,* Gravesend: F. R. Turner.
Turner, F and Stewart, W 1996. *The Maunsell Sea Forts. Part Three: The World War Two Thames Estuary Defenders, The Human Element,* Gravesend: F. R. Turner.
Turner, F 2001. *The W.T. Henley Telegraph Works*. Gravesend.
Turner, H 1971. *Town Defences in England and Wales.* London.
Vine, PAL 1972. *The Royal Military Canal*. Newton Abbot.
War Office 1903. *Handbook of the London Defence Positions.* War Office.
Welby, D 1991. *The History of Archlcliffe Fort.* Dover.
Wills, H 1985. *Pillboxes: a study of UK defences 1940.* London: Leo Cooper.
Willis, S and Holliss, B 1990. *Military airfields in the British Isles 1939-1945.* Newport Pagnell: Enthusiasts Publications.
Wilson, G 1976. *The Old Telegraphs.* London.
Wilson, JD 1963. Later Nineteenth Century Defences of the Thames. *Journal of Army Historical Research*. XII, 141-58.
Wood, D 1992. *Attack Warning Red*. Portsmouth.
Wood, D and Dempster, D 1961. *The Narrow Margin.* London.
Woodburn, B. 1999. 'Fortifications and Defensive Works 1500-1900' in K Leslie and B Short (eds.) *An Historical Atlas of Sussex*: 102-3.