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Cliffe Fort, Hoo Peninsula, Medway, Kent

Investigation and analysis of the 19th-century Coastal Artillery Fort

Andrew Williams and Sarah Newsome

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CLIFFE FORT
HOO PENINSULA
MEDWAY, KENT

INVESTIGATION AND ANALYSIS OF THE 19TH-CENTURY COASTAL ARTILLERY FORT

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SUMMARY

In 2010 the former English Heritage Archaeological Survey and Investigation team undertook a detailed survey of Cliffe Fort, a coastal artillery fort built in the 1860s. The fort is located on the Hoo Peninsula, Medway, in the parish of Cliffe and Cliffe Woods, on the south side of the Thames. It is 3 km west of Cliffe village in the area of the former cement works.

The fort is a Scheduled Monument and is on the Heritage at Risk register, where, due to flooding, vandalism and partial collapse, the condition of the structure is described as 'very bad'. The fort has had little previous investigation and was identified as needing detailed research by the Hoo Peninsula Historic Landscape Project, a multidisciplinary landscape project which aimed to increase our knowledge and understanding of the peninsula in order to contribute to strategic decision-making. The survey results will inform the future management of the site and provide an enhanced designation base.

Cliffe Fort was part of a large and expensive defence infrastructure programme undertaken in the 1860s and incorporated the latest in fortification theory and technology. It was one of the last casemated forts with iron shields to be completed. Investigation revealed that despite some almost immediate alterations to the basement magazines, a lack of alteration in the 20th century has preserved a number of areas in the fort that reflect its late 19th century use. Later adaptations for rooftop guns reflect the changing nature of conflict through the 20th century. Research has also revealed that the fort contains one of the best preserved of the rare Brennan torpedo installations, including the remains of a unique rising observation tower.

CONTRIBUTORS

Sarah Newsome, Wayne Cocroft, Dave Went and Andrew Williams undertook the fieldwork. Derek Kendall undertook professional photography. Andrew Williams prepared the illustrations, researched and wrote the report with contributions from Sarah Newsome.

ACKNOWLEDGEMENTS

The project team is grateful to Brett Ltd for allowing access to the site and to the Kent Bat Group for their generous help and advice. The team would also like to thank Victor Smith for sharing his extensive knowledge of Kent's military defences.

ARCHIVE LOCATION

The project archive is located at the Historic England Archive, Swindon. It includes a hand-written gazetteer of survey notes.

DATE OF SURVEY

The survey was undertaken between June and September 2010.

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1. INTRODUCTION

In 2010 the former English Heritage Archaeological Survey and Investigation team undertook a detailed survey of Cliffe Fort, a coastal artillery fort built in the 1860s. The fort is located on the Hoo Peninsula, Medway, in the parish of Cliffe and Cliffe Woods, on the south side of the Thames at NGR TQ7068 7671. It is 3km west of the village of Cliffe in the area of a former cement works (Figs 1 and 3).

The fort is a Scheduled Monument (ME269/1003403) and is on the Heritage at Risk register, where, due to flooding, vandalism and partial collapse, the condition of the structure is described as 'very bad' (English Heritage 2011, 61). The slipways relating to the Brennan torpedo are not covered by the scheduling. The fort has had little investigation in the past and was identified as a key site in need of more detailed research by the Hoo Peninsula Historic Landscape Project, a multidisciplinary landscape project which aimed to increase our knowledge and understanding of the peninsula in order to contribute to strategic decision-making. The results of the survey will inform the future management of the site and provide an enhanced designation base.

Figure 1: The location of Cliffe Fort © Crown Copyright [and database rights] 2017. OS 100024900

The fort was surveyed in six weeks between June and September 2010. The survey involved producing room-by-room descriptions and taking record photographs. Using a set of plans dating to 1899 (TNA: WO78/4963; App Figs 1, 2, and 3), any differences or alterations were identified. These were recorded using graphical survey techniques. Professional photographs were also taken. In some areas flooding, unsafe structures or the presence of bats restricted the survey. Electronic survey techniques were used to record alterations to the roof of the fort and a rapid walk-over survey of the glacis (at the front of the fort) was undertaken. Further details are given in the Methodology section at the end of this report.

The fort is currently in the ownership of Brett Aggregates Ltd and there is no public access to the site.

2. TOPOGRAPHY AND GEOLOGY

Cliffe Fort is located on the south bank of the River Thames, between Higham and Cliffe Creeks, at the point where the river turns north before heading east once more towards the Thames Estuary. It now appears isolated within the extensive quarries relating to the former Portland cement works (Fig 2). The fort is located to the north of Shornemead Fort and opposite the Coalhouse Fort at East Tilbury in Essex (Fig 3).

The fort is situated on a low-lying area of reclaimed salt marsh at a height of around 3m above Ordnance Datum. It sits on alluvium which overlies Lewes Nodular, Seaford and Newhaven Chalk formations (http://maps.bgs.ac.uk/geologyviewer/ - accessed 9/3/12).

Cliffe Fort provides a habitat for a variety of wildlife including a number of protected species. It is home to a maternity roost of Daubenton bats as well as other bat species and water voles.

Figure 2: The topographic setting of Cliffe Fort. (HEA 26474/018)

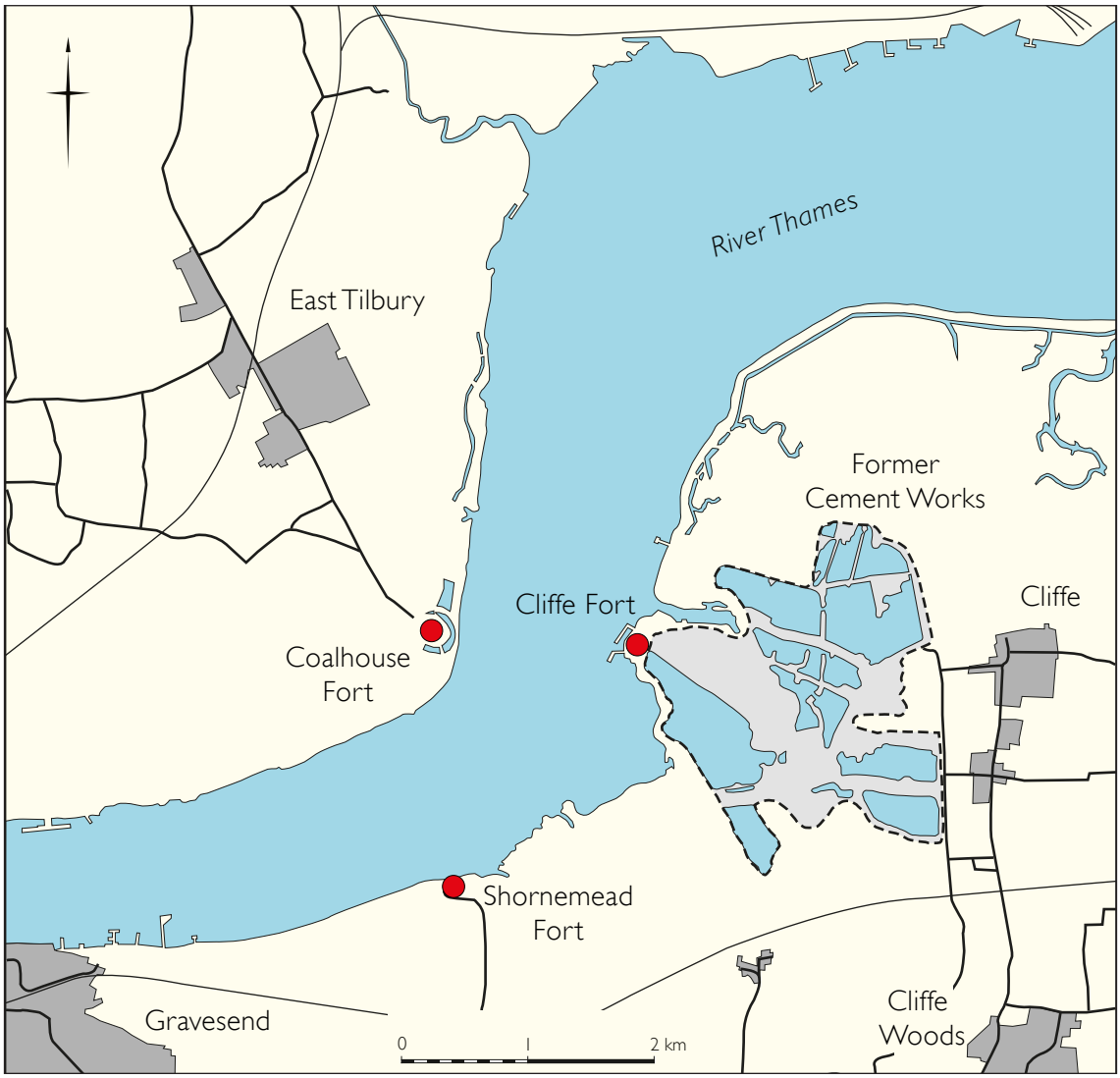

Figure 3: The location of Cliffe Fort in relation to Coalhouse Fort, Shornemead Fort, Cliffe village and the former cement works © Crown Copyright [and database rights] 2017. OS 100024900

3. PREVIOUS RESEARCH

Previous research into Cliffe Fort has been limited, at least in part, by access restrictions. The only known detailed archaeological survey of part of Cliffe Fort was conducted in April 1993 by the Royal Commission on the Historical Monuments of England (Pattison 1993). This survey was conducted following a request from Kent County Council and recorded the two launching bays of the Brennan torpedo installation which were threatened by repairs to the river bank.

Profiles and plans of both launching bays were produced using electronic survey techniques and a photographic survey (HEA photographic job: 93/48019) was also undertaken. The measured survey only records the launching slipways and the section of sea wall between them and the current fort boundary. The photographic survey includes the interior of the torpedo store and the engine room. A short report describes the condition of the launching bays and places them in historical context (Pattison 1993).

Cliffe Fort is briefly noted in a number of other reports including the *North Kent Rapid Coastal Zone Assessment Phase II* (Wessex Archaeology 2005). The majority of these reports are not detailed and none of the authors appear to have entered the fort. The *North Kent Rapid Coastal Zone Assessment* identifies a number of features on the shoreline which could be the remains of the pier and observation post for the Brennan torpedo installation.

Cliffe Fort is briefly discussed, usually as an adjunct to Coalhouse and Shornemead forts, in several articles dealing with the Thames defences. Most noteworthy is the article by Wilson (1963) "Later nineteenth century defences of the Thames, including Grain Fort". The fort is referred to in passing, and in the context of the wider Thames defences, in subsequent publications, notably Bennett (1977) *A Handbook of Kent's Defences from 1540 until 1945* and Gulvin (1976) *The Medway Forts. Several works, by Victor Smith notably Defending London's River* (1985), discuss Cliffe Fort in the context of the wider Thames defences and its counterparts at Coalhouse and Shornemead. A more detailed description of the fort, including a succinct history, is included in Part One of the *Kent's Defence Heritage* gazetteer (Saunders and Smith 2001, entry number KD 123 dated November 1998).

The Brennan torpedo installation at Cliffe is included in Beanse's excellent history and description of the weapon *The Brennan Torpedo* (1997). This work is an overview of the history, technical development and operational use of the torpedo from the late 1880s until 1906. Photographs of the installation at Cliffe are used to illustrate various technical points but a description of the installation, mainly of the launching bays and the roof of the torpedo store, covers only two pages including a plan based on the basement plan in The National Archives (TNA WO78/4963) and the RCHME survey (Pattison 1993). The Cliffe installation, particularly the origins of the rising observation tower, is also discussed in Kitson (1999) *The Brennan Torpedo, Monorail and Helicopter: A study of innovative activity in the process of forming three related military weapons*. The author makes it clear that his conclusions are based on documentary evidence and a brief field trip to Cliffe Fort with Beanse.

4. DOCUMENTARY SOURCES

> 'there is less [documentary] information in existence about Cliffe Fort than about any other work except New Tavern [Fort]' (Wilson 1963, 185)

Though Wilson's comment is accurate, plans of Cliffe Fort were certainly prepared; a letter to Captain (acting Lieutenant Colonel) Charles Gordon requesting the return of the plans of Cliffe Fort to the office of Colonel Jervois, Deputy Director of Works, is dated 20 October 1868 (TNA: WO30/106). On 6 December 1875 an order was issued to Corporal Pearson of the Royal Engineers to proceed to Cliffe Fort for the purposes of taking measurements for the record plans in the course of preparation (SME GRA/0/9).

These plans have not been located. The only comprehensive set of plans and sections for Cliffe Fort held in The National Archives (WO78/4963; App Figs 1, 2 and 3) is dated 22 June 1899 and shows Cliffe Fort after a major rebuild had removed many of the gun positions and altered the roof. Sheet 1, which presumably shows the foundations and earthworks, is missing. The areas housing the Brennan torpedo installation of circa 1890 are completely omitted, presumably for security reasons. Small errors, such as missing room partitions or the traversing arcs of some gun positions, suggest that the plans were redrawn from a more detailed master set. The three plans (basement, gun floor and roof, see App Figs 1, 2 and 3) and the four sections on a single sheet all show the drainage arrangements in great detail accompanied by an extensive key, suggesting they were created for this reason. Ironically, the depiction of the drainage arrangements in such detail reveals the presence of the secret Brennan installation as the basement plan shows its position by the course of the specialised drainage system for its steam engine.

Other items in the portfolio (TNA:WO78/4963), which contains plans and sections of Cliffe Fort spanning the years 1891 to 1936, show various areas of the fort in varying scales and detail. The most comprehensive, after the 1899 set, are a group dated between 1913 and 1918 regarding the installation of 6-inch and then 4-inch guns in barbettes on the fort roof. A plan dated 1915 concerning modification to the former Brennan installation boiler room provides the only evidence, in an official document, for the existence of the rising observation tower for the installation. A detailed list of the maps, plans and sections that can be found in the portfolio can be found at the end of this report (Chapter 16).

A small number of written sources concerning Cliffe Fort, mostly letters, for the period between 1865 and 1871, have survived. Almost all of them are signed by, or on behalf of, Captain (acting Lieutenant Colonel) Charles Gordon then Chief Royal Engineer (CRE) at Gravesend; his later fame as Gordon of Khartoum has ensured their survival. Four volumes in The National Archives (TNA: WO30/106; WO30/107; WO30/108; WO30/109) contain holographs of letters received by Gordon between these dates; they are fully indexed with many discussing the construction of Cliffe, Coalhouse and Shornemead Forts along with the completion of the rebuilding at New Tavern Fort in some detail. At the library of the Royal School of Military Engineering, Brompton Barracks, Chatham, a notebook, 'Gravesend

Order Book from January 1866 to December 1878' (SME GRA/0/9) survives. This notebook contains a running list of the orders of the day issued by Gordon. Like the letters in The National Archives, it has probably been preserved due to his later fame. Also at the library of the Royal School of Military Engineering is the Cliffe Fort Correspondence File which contains modern correspondence related to Cliffe Fort and a newspaper cutting dated 1980. Of most interest is correspondence from 1980 between Major A Nutter, late Royal Artillery, and the respective librarians of the Royal School of Military Engineering and the Royal Artillery Institute concerning documents relating to Cliffe Fort. The file ends with an unequivocal letter dated 10 September 1980 stating that neither institution holds any primary material later than 1869 concerning Cliffe Fort.

Correspondence between the Thames Sewer Commissioners and the Chief Royal Engineer Gravesend, dated between 1888 and 1890, held at the Centre for Kentish Studies, Maidstone (CKS NK/A/C/1/17), concerns alterations to the sea walls at Cliffe, Coalhouse and Shornemead. Two letters dated October 1888 discuss the construction of the apparent Submarine Mining observation posts for which drawings are appended. The name and function of these posts is not mentioned but the drawings are unmistakably of the standard design for this type of observation post. Letters dated 1889 and 1890 concern alterations to the sea wall in front of Cliffe Fort. The reasons for these alterations only becomes clear in the last letter, dated 3 April 1890, when oblique references are made to a 'railway' passing through the fort glacis and sea wall at Cliffe. This, along with other incidental details in the earlier letters, is taken as a deliberately obscure reference to the then top secret Brennan torpedo installation.

Shornemead and Coalhouse forts have far more extensive collections of drawings and records, providing both information about fixtures and fittings common to all three Thames forts and a basis for comparison. One volume of the *Fort Record Book 1911-1943* (TNA: WO192/48) for Coalhouse Fort survives which includes passing references to Cliffe Fort at the outbreak of both the First and Second World Wars. Relatively more documentary evidence may survive for these forts than Cliffe because they both remained in military use until after the Second World War. Shornemead was part of a military training area until the 1980s (Smith 2007, 2). One of the few documentary references to Cliffe during the Second World War (TNA: WO199/2478) reveals that by 1940 it had become the property of the Alpha Cement Company and drawings and documents may have been transferred to its new owners.

Another possible reason for the lack of documentary evidence for Cliffe is referred to by Wilson (1963) in his article on the Thames defences. In 1959 a fire at the Chatham garrison works office apparently destroyed the Gravesend district Royal Engineers' letter books for the period after 1868 and perhaps much else besides (Wilson 1963, 194).

Map Evidence

Cliffe Fort is located on sheet Kent IV.13 of the Ordnance Survey County Series 1:2500 scale survey. In common with all military establishments, and other institutions considered to be secret such as prisons and explosive works (Oliver 1993, 69), Cliffe Fort was not shown on any published Ordnance Survey map until it was decommissioned at the end of the Second World War. The initial 1:2500 scale survey of Kent undertaken in 1861, published around 1866, shows the location of Cliffe Fort as marshland (Sheet IV.13) as the survey predated its construction. The first revision was undertaken in 1895 and published in 1897 (Ordnance Survey 1897). This forms the basis for the confidential or military survey showing Cliffe Fort and its earthworks, including a single Brennan torpedo slipway, in detail. This survey was used as the basis for various plans held in The National Archives (see TNA: WO78/4963 and WO78/5134). The second revision was conducted in 1907 and published in 1908 (Ordnance Survey 1908); judging from the documents available in The National Archives this revision did not include a confidential edition as documents dated as late as 1936 still use the 1895 survey. The third (partial) revision was undertaken between 1929 and 1933 and did not extend to the Hoo Peninsula, but the fourth (incomplete) revision, undertaken between 1937 and 1940, did (Oliver 1993, 145). The sheet included in this revision was surveyed in 1937 and published in 1940 but this still does not show Cliffe Fort (Ordnance Survey 1940). Subsequent post war 1:2500 and the metric National Grid equivalent editions (1958 to 1979) of the Ordnance Survey Map (TQ 77 NW) show the fort in outline with earthwork detail.

5. THE CONSTRUCTION OF THE FORT

Historical Context

Cliffe Fort is one of the so-called Palmerston Forts, a group of mainly coastal fortifications built in the mid-19th century. These were built after the 'Three Panics', a period of strategic reassessment, public anxiety concerning the intentions of the new French Third Empire and political campaigning on the subject of defence. The first panic occurred in 1847 with the report of the Inspector General of Fortifications, General Burgoyne, into the poor state of the nation's defences given what was perceived as a renewed military threat from France. The second, in 1852, was centred around a campaign in parliament, led by Lord Palmerston, based on the notion that the French navy, operating from a new dockyard in Cherbourg, could mount a rapid and successful invasion of the South Coast in a single night. The final panic followed the unexpected launch in 1859 by the French of the world's first ironclad warship *La Gloire*, and the subsequent rapid completion of 14 others, and the threat, real or not, that they were thought to pose to the supremacy of the Royal Navy. After a parliamentary enquiry in 1859, *The Report of the Royal Commission Appointed to Consider the Defences of the United Kingdom* was published in 1860. Amongst its recommendations were improvements to the defences around the nation's dockyards and major ports by the construction of 19 new forts and 57 batteries (Douet 1998, 151). This was enacted in a bill presented to parliament in July 1860 in which Lord Palmerston requested a budget of £9 million for the works of fortification alone (Saunders 1989, 175).

In considering the Thames defences the 1860 report stated that:

> The defence of the Thames involves interests of vast magnitude; it includes the security of the great powder magazine establishment at Purfleet; the important arsenal at Woolwich and the adjoining dockyard, the Government victualling stores and ship-building yard at Deptford, the large amount of valuable property extending for many miles on either bank of the river, the fleet of merchant shipping moored in the port of London, and, lastly, the metropolis itself
> (Royal Commission 1860, xliv)

For the Thames fortifications it was agreed that existing locations, many of which had been first established in the 1500s if not earlier, were acceptable but that the condition of the defences was not. The report proposed that:

> We consider that the part of the river between Coalhouse Point and the opposite bank, where it is about 1000 yards broad, is that best adapted for preventing, by means of permanent works, the further advances of a hostile fleet...We recommend that Shornemead Battery, which is admirable situated, should be enlarged...At Coalhouse Point, on the left bank, a powerful battery should be placed in addition to or in extension of the existing one, bringing the principal part of its fire to bear down the river and across the

> channel, but having some guns also bearing up the river in the direction of Gravesend. In addition to these, a work should be constructed on the right bank, opposite Coalhouse Point, at the southern entrance to Cliffe Creek; and a floating barrier should be moored in times of war across the river, under the protection of these batteries, a passage for our own vessels, for closing which every possible precaution should be taken in time of expected attack. (Royal Commission 1860, xliv-xlv)

The report also recommended that Tilbury and New Tavern Forts should be modernised and that their guns should cross fire with those at Coalhouse Point and Shornemead, and that another floating barrier should be strung between Tilbury and Gravesend. In order to link the Thames and Medway defences, a fort at Allhallows, Kent, was proposed (Royal Commission 1860, xlv; xlix). Given the continuity of the battery sites on the Thames (for instance: a battery at Coalhouse Point, the East Tilbury Blockhouse, was first recorded in 1540 [Brown & Pattison 2003, 3]), the establishment of an entirely new site at Cliffe Creek is notable.

The Cliffe Creek battery would supersede the battery at Hope Point and the abandonment of this long-established position must have been for good tactical reasons. No primary sources have come to light that elucidate this decision. It is reasonable to suggest that the Royal Commission's analysis focused on two points; the central part that booms and obstructions, which now included the new technology of moored minefields, played in the defence of the Thames, and the problem that the new iron-clad warship posed to the smooth bore artillery of the early 1860s. The report of the Commission is clear that, in time of war, a boom obstruction was to be strung across the Thames between Coalhouse Point and Cliffe Creek (Royal Commission 1860, xlv). The intended battery at Cliffe, along with the one at Coalhouse, would defend the passage through the boom and the boom itself against ramming by warships or attempts to destroy it by storming parties in small boats; the boom would also slow or halt an enemy vessel making it a better target for the batteries. The smooth bore 68-pounder gun, intended as the main armament of these batteries, would certainly damage or sink a wooden warship but its effectiveness against an iron-clad warship was in doubt (Hogg 1974, 89) and the batteries at Coalhouse and Cliffe, with their intended armament of 68-pounders, might have stood more chance of damaging or sinking one by establishing a cross fire.

Subsequently the new Rifled Muzzle Loader (RML) guns developed by Armstrongs in the early 1870s would provide a potentially more effective weapon against the iron-clad warship. With these new weapons (which had ranges of over 4000 yards) (Hogg 1974, 89) the batteries at Cliffe Fort and Coalhouse Fort covered the deep water passage of the Thames. Given the range of the RMLs the guns of either battery could, theoretically, cover the whole Thames without the need to establish a cross fire, making one of the batteries largely superfluous before it was even commissioned. This may account for the continued development of Coalhouse Fort which displays several subsequent phases of upgrading, rebuilding and rearming (Brown & Pattison 2003, 1-5) while Cliffe Fort had received only minor upgrades

and was disarmed completely in 1906 to be briefly recommissioned with only two guns prior to the First World War.

The Construction

The Inspector General of Fortifications and the Royal Engineers

In common with other fortification works of this period the defences were built by a series of contractors supervised by nominated officers of the Crown. The works in the Thames district were supervised by the Chief Royal Engineer (CRE) Gravesend. The CRE reported to the Inspector General of Fortification and Director of Works at Horseguards in Whitehall. Between 1870 and 1875 the Inspector General was Sir Fredrick Chapman who had been preceded by Sir Edward Frome with an interregnum between 1869 and 1870. However, Colonel William FD Jervois, Deputy Director of Works (Fortifications) and Secretary to the 1859 Commission, had direct responsibility for overseeing the construction of the works recommended by that body (Saunders 1989, 171) and it appears that Captain T Silborne RE was responsible for designing or supervising the Thames and Medway forts (Crick 2012, Appendix A).

As previously noted, between 1865 and 1871, during the main phase of construction and significantly during the extensive discussions on the design of Cliffe Fort, the Chief Royal Engineer (CRE) at Gravesend was Captain Charles Henry Gordon. Gordon had been breveted Lieutenant Colonel in 1864 after an extraordinary career that had seen him decorated for actions in the Crimean War and created a Companion of the Bath for his leadership of the 'Ever Victorious Army' for the Emperor of China. On his return from China Gordon was given the post of CRE Gravesend while suitable work was found for him. He did not appreciate so pedestrian an appointment and did not give the Thames forts his full attention. Instead he lobbied for a new overseas posting, underwent an evangelical conversion and began a mission to the poor, donating the majority of his salary and opening a mission building in Gravesend (www.wiki/General Gordon/ created 15 April 2003).

Gordon's lack of focus on his duties is reflected in his testimony to the 1869 *Committee on the Construction, Cost and Condition of the Fortifications erected... under 30 and 31 Vict... on the structural problems of the Thames forts* (House of Commons 1869, Appx 1) which reads as offhand and disinterested, in the CRE letter books where his working hours are reported as 8.00am to 2.00pm, and in his leave sheets for 1870 which show frequent absences on personal matters (TNA: WO30/107/197). He left England in 1877 for a diplomatic and political career which would end in his murder during the fall of Khartoum in January 1885. His successor was Lieutenant Colonel the Honorable George Wrottesley, who remained in the post until his transfer to Woolwich in July 1875 (REL GRA/0/9). Assistant to both men, and Commander of Royal Engineers in the Gravesend district was Captain William Newsome RE. He took up his duties on 19 August 1868 (REL GRA/0/9) and his work supervising the construction of the Thames Forts was obviously appreciated as he was promoted to Major on 1 June 1873 (Anon 1880).

The Contractors

A select group of civil engineering and railway contractors with the necessary experience to undertake work on fortifications was mentioned in the correspondence between 1869 and 1873. Wrought iron joists were supplied by Mr H Barrett (TNA: WO30/108/85) the patentee of the Fox and Barrett fireproof roofing system. Messers Jackson and Shaw were contractors for the gorge buildings at Coalhouse and preferred bidders for Cliffe and Shornemead (TNA: WO30/106/113; WO30/106/66). Aird & Sons, Belverdere Road, Lambeth, were a reputed firm of civil engineering contractors who specialised in, amongst other things, railway construction and utilities. For the Thames forts their numerous contracts included supplying earth for the glacis at Cliffe and Shornemead, building the sea wall at both forts and delivering and installing the frames for the armoured shields (TNA: WO30/106).

Foremen and Tradesmen

The majority of people employed on the construction of Cliffe were skilled tradesmen working for contractors. However a few men were directly employed by the government to supervise the site and the valuable stores and materials used in its construction.

On 14 September 1866, during a period of suspension of work at Cliffe, Edward Ball was appointed caretaker at 18 shillings a week with an additional 6 shillings for lamp lighting on the creek jetty. In 1870 he was replaced by JM Tennant, Superintendent Foreman of Works for Cliffe Fort (TNA: WO30/106/159). On 8 February 1870 he was supplied, along with the master gunner at Shornemead, with a pair of mud boots and a subsequent letter reminded the CRE that the boots should be returned to RE stores when finished with (TNA: WO30/107/33; WO30/107/41). These boots were a practical solution to the difficult water-logged conditions at Cliffe. The census return for 1871 shows that Tennant and his family were in residence at the fort:

> James Tennant, aged 31, born 1840 Scotland
>
> Mary Ann Tennant, Wife, aged 26, born 1845 Oxfordshire
>
> James Daniel, son, aged 8, born 1863 South Africa
>
> Mary Jane, daughter, aged 4, born 1867 Scotland
>
> Harry Erm, son, aged 2, born 1869 Ireland
>
> Helen Catherine, daughter, aged 0, born Kent
>
> Mary Ann Prichard, step sister, aged 22, born Scotland
>
> (www.findmypast.co.uk 1871 transcript details for Cliffe Fort, Cliffe at Hoo, Kent)

Letters concerning a complaint brought by Captain Newsome on 1 October 1872 about the drifting of noxious smoke from the growing number of kilns in the adjoining works of Francis and Co, cement manufacturer, show that many of the workers lived at a shanty town on the site. Newsome's letter lists the

names, occupations and length of residency of some of the key workers (TNA: WO30/108/154):

> Elijah Woodhouse, carpenter has lived in the huts at Cliffe Fort for 2 years
>
> William White, bricklayer has been at work and lives [sic] at the fort for over 2 years.
>
> Thomas Remington, mason has been at work on the fort for 2 years
>
> Lelitia Hills, wife of Ralph Hills has been living in the huts for 2½ years has often tried to persuade her husband to leave the works on account of the smoke from the cement works.
>
> Susan Shepherd, keeps a hut for lodgers and has been living at Fort over 12 months.

Another letter of 18 May 1872 discusses the case of Mr Thompson whose canteen at Cliffe had encroached on War Office property. Mr Thompson is reminded that his business, described as a shanty, is only there for the convenience of the contractors and further encroachment on government property will not be tolerated (TNA: WO103108/113). Eventually a 156ft (35m) high chimney was erected to carry the fumes from the cement works clear of the fort.

The Foundations

In August 1860 test borings were made at Cliffe Creek to a depth of 42ft revealing a soil of peat, sand and clay. This unpromising geology for the foundations of a major work of fortification does not seem to have been considered a problem as the War Office requisitioned the land in 1861 under the provisions of the 1860 Defence Act (TNA: WO332/52). A letter from Captain Newsome to the Treasury Solicitor dated December 1872 (TNA: WO30/108/154) demonstrates that construction of the fort's foundations began the same year as the purchase.

Colonel Jervois and Lieutenant Colonel Gordon's evidence to the 1869 *Committee on the Construction, Cost and Condition of the Fortifications Erected or in the Course of Erection under 30th and 31st Vict and Previous Statutes* (House of Commons 1869) details the progress of the Thames forts from their inception under the 1860 Act to May 1868. The 1860 committee had recommended that the battery at Hope Point be replaced with a new battery at Cliffe Creek armed with 30 guns and manned by 300 men. This battery would triangulate fire with the rebuilt works at Coalhouse and Shornemead. It was assumed, as with all the coastal batteries recommended by this committee, that the weapons would be smooth bore 68-pounders mounted either *en barbette,* surrounded by an earthern or armoured parapet, or in casemates.

Plans for the work were finalised in November 1860. Cliffe would have a 20 gun battery in granite-faced casemates with iron shields, 13 guns with iron shields on the terreplein above and three guns mounted *en barbette,* with two for local defence which would fire through masonry embrasures. It is not clear if these guns were additional to the three *en barbette* or not. The work would have a quadrant front

flanked by musketry caponiers and the gorge buildings would form a bastioned rear. A main magazine, four shell-filling rooms and four expense magazines would be provided. The work would have a concrete foundation slab 7ft thick. The contract for the foundations was let in July 1861, the specification calling for them to be 55ft in width and 8ft in depth with 30ft deep timber piling. During excavation the depth of the foundations was increased to 14ft, following the example set at Coalhouse Fort. This concrete bed is shown clearly on the sections of the casemates included with the plans of 1899 (TNA: WO78/4963 Plan No 5). The foundations to the casemates use the 30ft timber piling to form parallel outside walls set 30ft apart, shuttering the 14ft deep concrete filling. The gorge buildings have conventional foundations of brick and masonry footings resting on a concrete slab. The scale of the piling work for Cliffe and Shornemead is illustrated by a letter of July 1870 listing the surplus timber after the driving of foundation piles at the two forts. Remaining at the Victoria Docks in July 1870 were six piles measuring 15ft by 12in by 12in, 483 measuring 10ft by 12in by 4in and 95 measuring 7½ft (TNA: WO30/108/53)

In August 1865 it was noted by Lieutenant Colonel Gordon and his staff that the slab was tilting by 3in toward the Thames. Accurate measurement was made difficult as the original site datum point could not be found. Heavy rain in October 1865 caused cracks to appear in the basement walls and the gorge foundations. As construction of the basement commenced these cracks continued to grow, reaching 5in on average, and the tilt of the slab increased to 13in but no new cracks appeared. Expert advice taken by committee, including that of the civil engineer in charge of constructing the adjacent cement works of Francis and Co, concluded that the slab was unevenly compressing the peat sub-soil. Counterweights were needed to allow the slab to settle evenly. Gordon pointed out that he had inherited the slab having been appointed CRE Gravesend in 1865. The Commission made a recommendation that the slab should be allowed to settle further and work be suspended until the cracks and settlement stopped. It was further recommended that the centring in the casemate arches should not be removed until all movement in the structure had stopped (House of Commons 1869, 142, 145, App 3).

On 20 February 1867 the War Office issued the *Report with Reference to the Progress made in the Construction of the Fortification for the Defence of the Dockyards and Naval Arsenals of the United Kingdom*. The report on the Thames Forts stated that:

> the works at Coalhouse, Shornemead and Cliffe Creek will each be casemated and in one tier, with basements under the batteries, containing magazines and stores and protected by a glacis... The gorge of each work will be enclosed by a defensible wall in connection with which part of the barrack accommodation will be provided. The works are situated on marshy ground and some difficulties have been experienced in the construction of foundations. These, however, are completed, the basement storeys have been constructed upon them, and they are ready to receive the superstructures...It is proposed that the superstructure of these works shall be of a construction specially calculated to meet the

> case of the foundations being on marshy soil. They will be iron-plated and the plates will be attached to segmental iron girders, the main girders having one end seating on the front wall, and the other end on the rear part of the basements. The batteries will be constructed as to be capable of receiving guns of 18 tons weight. (Jervois 1867, 123)

In September and October 1868 letters discussed the resumption of work on the basements of Shornemead and Cliffe along the lines of those already in progress at Coalhouse (TNA: WO3106/66 & 71). A letter from Lieutenant Colonel Gordon dated 2 November 1868 noted that the bore hole at Cliffe had not been pumped for two years confirming that work had been suspended as intended in 1866 (TNA: WO30/106/74); this is also the date when Bell the caretaker was appointed. A letter of January 1869 from Colonel Jervois to Gordon makes it clear that the extensive redesign of Cliffe and Shornemead was occasioned by the need to build far more substantial foundations than at first proposed. Gordon is specifically requested to make observations on the probable stability of the new foundations (TNA: WO30/106/90). The subsequent letter from the fortifications committee enquires further about any subsidence or slips that have taken place at the works under construction (TNA: WO30/106/91).

Colonel Jervois' evidence to the parliamentary committee on 16 March 1869 (House of Commons 1869, App 1) outlined the extent and complexity of the redesign. The 1867 design for all the Thames forts, which had proposed a semi-elliptical trace, casemated batteries and iron superstructure, was abandoned. It was now proposed that Cliffe and Coalhouse would be reconstructed; the movement and cracking at Shornemead was so severe that work was to remain suspended until it was certain that the foundations were stable, retaining the basement and magazine works that had already been completed. The contract for basement works was let in November 1865 and Gordon's testimony to the 1869 committee suggests that they were completed, or close to completion, in May of that year. The 1869 redesign of the Thames forts considered three options, though it is clear from Jervois' and Gordon's submission to the committee that no option had been firmly adopted:

Option A would see 20 guns mounted in iron-shielded casemates

Option B would see 7 guns in iron casemates and 6 in Moncrieff disappearing positions

Option C would mount 10 guns in granite-faced casemates alternated with 7 guns in Moncrieff pits

All of the options would mount 10-inch 18 ton Rifled Muzzle Loader (RML) guns.

Costs and Progress

Thames Defences: Cliffe Fort, expenditure applicable to loan:	
Estimated amount for completing this fort in a similar manner to the work at present executing at Coalhouse Fort the whole of the Gorge buildings being new	£34591
Ten guns at £ 2,148	£21480
Artillery store at end of parapet = value of one gun	£2078
Three caponiers at £370 each	£1110
Glacis consequent on adoption of Moncrieff system	£750
Contractors surveyors charges	£510
Add to contingencies to cost of guns and buildings	£1443
Add expenditure already incurred on this fort	£39440
Additional work for Moncrieff pits 11 x £393 each	£4323
Authorised by Act of 1869	£105727

(TNA: WO30/106/127)

The letters book for 1869 contains a series of abstracts from reports supplied to the parliamentary commission overseeing the construction of all the defence works. Included are the estimates agreed between Jervois and Gordon for the resumption of the works at Cliffe. The amounts allowed for the Montcreiff mountings suggests that options B and C were considered the most likely outcomes. By comparison the works at Portland, Dover and the Medway had all spent the majority of their estimates by June 1869, illustrating the slow progress on the Thames Forts particularly Cliffe and Shornemead (TNA: WO30/106/120).

Proposed expenditure as Column 5 Statement of expenditure to complete	Works Commenced	Works not Commenced
Scarp (£1100) and Ditch (£100)		£1200
Outwork alterations		£200
Foreshore and sluices		£750
Drainage works		£2000
Traverses and parades		£300
Barrack fittings		£500
Water supply		£350
Small arms and gun sheds		£150
Interior alterations		£700
Chemin de les rondes, exterior alts		£600
Cement and concrete		£1000
Caponier		£1500
Counterscarp concrete		£320
For iron Moncrieff in rear of basement projected for Cliffe		£3872
Total:		£44534

(TNA: WO30/106/127)

A Resumption of Works

The concluding paragraph of Colonel Jervois's letter to the CRE of 23 September 1869 indicates that a fresh start on the works at Cliffe and Shornemead was being considered:

> And if the CRE concurs it is proposed to proceed with the partial execution of the glacis, and with the drainage and the sea walls of the forts. (TNA: WO30/106/138)

By 29 December 1869 work was about to recommence. A letter of that date notes that it was desirable to start drainage works at Cliffe at once and enquires about a reserve of large-bore 12in diameter water pipes held at Grain (TNA: WO30/106/171). A letter dated 5 January 1871 requests that these pipes be delivered by barge to both forts in the near future (25ft of pipe being required to link the interior of Cliffe Fort to the saltings) (TNA: WO30/107/20).

The Glacis

The glacis is the gentle earthen slope extending from the face wall of the fort which is designed to protect the fort from shell-fire whilst providing no cover for the enemy. Work started on the glacis at Cliffe in the early 1870s. The contract for 30,000ft^3 of earth for the glacis and sea wall at Cliffe and Shornemead was let to Aird & Sons, Lambeth, between 30 November and 1 December 1869 (TNA: WO30/106/156 & 157). Progress appears to have been slow as it was not until 21 April 1870 that around 18,000yd^3 of earth were delivered by barge to complete the glacis at Cliffe; completion was estimated for May 1870 (TNA: WO30/108/34).

The estimate proved to be wrong. On 4 June 1870 further earth was delivered for the stopping up of the foreshore, with the contractors willing to move in further earth, approximately 1,000yd^3, to stop up the two large gaps in the glacis and increase the height as instructed (TNA: WO30/108/43). On 29 June, Aird & Sons reported that a further 15,668yd^3 would be required to complete the glacis at Cliffe to the revised specification, over and above the 1,000yd^3 used for filling in the gaps (TNA: WO30/108/50). On 5 July Colonel Jervois wrote to the CRE asking for a full explanation of the delays (TNA: WO30/108/54). In reply, on 1 September, Gordon stated that the earth had settled and sunk far more than anticipated and that the increase in height to 18ft had also absorbed far more earth than had been allowed. It had been assumed that the space between the bottom of the basement and the minor slope of the glacis had been filled, which was not the case. Along with an allowance for the stopping up of an old ditch close to the glacis Gordon estimated that 19,442yd^3 at £1 11s per yard, £186 3s in total, would be required to complete the glacis as per the submitted plan (TNA: WO30/108/56). Gordon's estimates were wrong; on 14 November 1871 Captain Newsome reported that the condition of the ramparts remained unsatisfactory (TNA: WO30/108/86).

On 4 July 1873 the CRE wrote to Jervois suggesting that the right flank of the glacis should be extended by an additional 30ft and raised 7ft to cover the masonry of the bastion of the gorge from direct fire from the river at a cost of approximately £436.

Examination of subsequent Ordnance Survey maps, particularly the annotated confidential military survey of 1897 (surveyed in 1895; TNA: WO78/5134) shows that the glacis on the right (north) side did extend around the river face of the fort to encompass the north-east bastion and provide an enfilade to the gorge and the fort entrance. It was cut back at the end of the 19th century to accommodate an oil store and later for a tramway (see Chapters 11 and 12). Its counterpart on the south side finishes in line with the face wall of the open battery. Additionally it was proposed to cut a trench 16ft wide to mark the boundary of War Office land using the spoil to backfill stagnant ditches between the boundary and the fort. This would be a wet ditch connected to the existing sluices and drains (TNA: WO30/108/217). Its course, running north-south from Higham Creek to Cliffe Creek across the peninsula and accompanied by War Office boundary markers 7, 8 and 9, can be seen on the 1897 1:2500 Ordnance Survey and subsequent maps. The ditch has now been obliterated by the use of this area as a loading ground for sand and gravel.

Sea Wall

As requested by Colonel Jervois, the construction of the sea walls for Cliffe and Shornemead forts commenced in tandem with the glacis works. On 2 December 1869 the CRE informed Jervois that excavation of the sea wall foreshore at both forts had commenced (TNA: WO3O108/10). Almost immediately, on 16 December 1869, £14 7s was requested by the CRE for repairs to the sea wall at Cliffe (TNA: WO30/106/163) and on 17 December 1869 permission was received from the Thames Conservancy for repairs to the foreshore at Cliffe and Shornemead, conditional on the use of stone pitching (TNA: WO30/106/167).

An assessment of liabilities at Cliffe and Shornemead dated 10 May 1870 reveals that the repairs to the sea wall were not successful; £656 was required for hardcore under the foreshore of Cliffe Fort. The appended explanation states that it was imagined that the saltings could be cut back to the freestone underneath but this could not be done as the freestone was not at the edge of the saltings and hardcore had to be used to fill in the gap. The glacis at both Shornemead and Cliffe had required more extensive works than envisioned with a corresponding rise in cost for more materials such as pipe work (TNA: WO30/108/37).

The sea face of the fort (Fig 4) continued to encounter problems. On 30 July 1872 Captain Newsome reported that the crest of the stone slope was at least 1ft below the level of the spring high tide; the action of the tide was smashing the stone facing and leaving it in a mass at the foot of the slope. He suggested that, 'The compleat most economical remedy against this evil' was to deposit earth in the form of a shallow glacis against the slope. His accompanying plan is neatly hand coloured (TNA: WO30/108/146/147). Study of the 1897 1:2500 Ordnance Survey map (surveyed 1895) suggests that Newsome's solution was adopted. The sea wall is depicted as sloping masonry and then as a section of banked earth between the masonry and the outer edge of the fort glacis, extending along the high water mark from the mouth of Cliffe Creek, past the fort jetty to the north of Higham Creek.

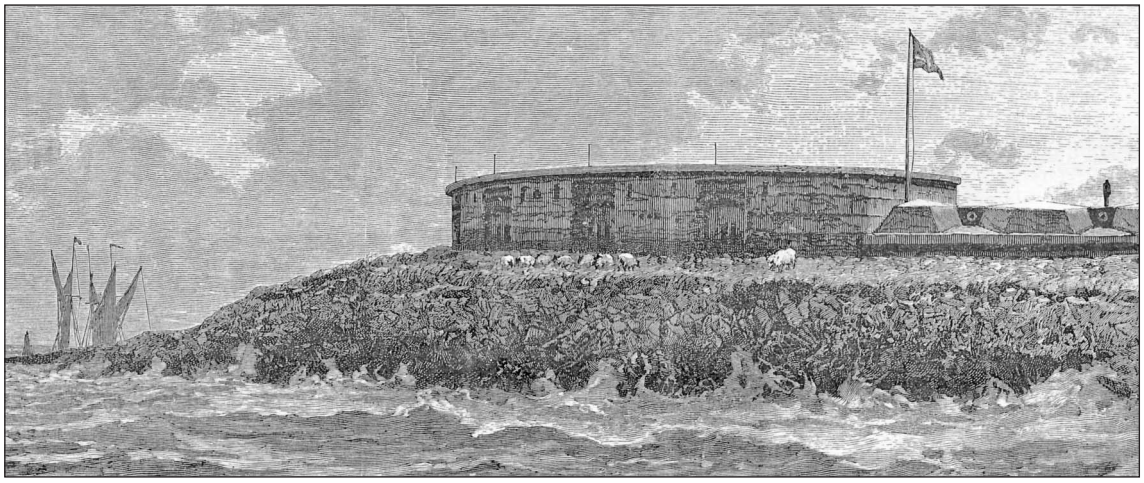

Figure 4: Engraving showing the sea face of Cliffe Fort included in an article entitled 'Our Coast Defences: the Forts at the Mouth of the Thames and Medway' published in The Illustrated London News*, 2 June 1888, 591. Throughout the article Cliffe Fort is referred to as Cliffe Creek Battery. (Courtesy of Peter Kendall)*

Water Supply

An important consideration for any work of fortification was the security of its water supply. In 1863 a well to supply the fort was sunk, hitting gravel at 60ft and chalk at 79ft. The water was described as wholesome (Jervois 1867, 123). However the well, sunk within the trace of the fortifications, turned out to be problematic and a series of letters and reports between 1868 and 1872 discusses in great detail the water supply arrangements for both Cliffe and Shornemead forts. In 1866 work on the well was suspended after brackish water started to enter the workings. Work resumed in 1868 with the same result and an analyst's report in 1869 suggested that the brackish water was rising from the chalk below the clay subsoil and was not caused by the movement of the tides (TNA: WO30/106/107). It suggested maintaining a constant flow using a wind pump or resorting to patent artesian well construction, although this was subsequently amended to a brick-lined well. This was sunk and its cover is visible on the 1899 plan (TNA: WO78/4963; App Fig 1) to the north of the lamp room in the north-east corner of the parade ground. The multiplicity of water pipes shown on this plan, running from an external mains supply and several storage tanks, suggests that in later years the well was retained for emergency use only.

Between 1869 and 1871 the water problem remained the subject of much correspondence between the CRE, Jervois and the research laboratories at Woolwich. A report from Woolwich of September 1871 concludes that attempting to sink wells in any of the Thames forts would always result in brackish water from the Thames entering the chalk and thence the water supply. It discusses the alternative of building two large brick cisterns at the forts. The report notes that the interior of both Cliffe and Shornemead forts are very boggy and this unstable ground would transmit any recoil from the heavy guns, cracking the cisterns at the very point they were most needed. If the cisterns were to be constructed they would have to be surrounded by a thick layer of puddled clay to absorb the impact. The more expensive alternative was to use a spring near Shornemead and pipe a supply to boiler plate

(wrought iron) tanks in the forts, running the pipe along the seashore where it would be easier to defend from attack. Annotation on the 1899 plan of Cliffe indicates a 4in water main running into the fort from Gravesend (TNA: WO78/4963; App Fig 1). A subsequent letter notes that sinking a well on the hills to the west would leave it vulnerable to shelling and cost more for pipes and pumps (TNA: WO30/108/84). The last piece of available correspondence in this series is a covering letter dated July 1872 for a set of plans for 9000 gallon galvanised iron tanks, each 30ft long and costing £160, to be buried under the earth rampart (presumably the one covering the rear wall of the basement) in the interior of the forts; this would keep the water cool and protect the tanks from gun fire (TNA: WO30/108/102).

The Basement

Construction work on the basement of the fort began in 1865 and was finished by February 1867 when a report was sent to parliament (Jervois 1867, 123). It is unlikely that the ammunition stores located in the basement beneath the guns were completed by this date as ammunition storage arrangements were in transition. Large centrally-located powder magazines set underneath the fort and intended to supply powder to ready-use magazines close to the gun positions for smooth bore 68-pounders or 7-inch RBLs, such as the one provided at Grain Fort (begun in 1860 and finished by 1865), were falling out of favour (Wilson 1963, 154). Their proposed replacements for use with the new RML guns mounted in shielded casemates, firing cartridge charges and fused shells, were being developed at Woolwich but the plans for these shell and cartridge stores were not finalised until 1868 or 1869 (House of Commons 1869, App 3; Wilson 1963, 143). A schedule of costs from 1873 (below) details some of the work required to fit the new ammunition storage arrangements into the completed basement at Cliffe. The subject of the fittings for stores and passages occupies much of the correspondence in 1873 suggesting that this work was being done at this date and had not been carried out earlier.

The table below suggests that considerable modifications to the recently completed basement had to be undertaken to convert the ammunition supply and storage arrangements to the new specifications. In particular, note the considerable sum of £165 required presumably for piercing the shell lifts through the vault of the basement.

Schedule of Costs: approx cost of the carrying of …….. Cliffe Fort March 30 1873	
Making good as shown	£400-00-0
..tia heavy making good	£12-00-0
blocks and eye bolts	£10-10-0
provision for lamp fittings providing magazine barriers	£40-00-0
Walk way	£32-00-0
To shell lifts	£165-00-0
Filling to shot lifts	£25-10-0
….to eyebolts	£15-00-0
Total:	£700-00-0
(TNA: WO30108/205)	

Figure 5: The interior of the fort in September 2010 from the south-east corner. From right to left, the main features that can be seen are the gorge wall with the recess for the murder holes over the entrance, the First World War Battery Observation Post, the gun casemates with the Submarine Mining Test and Engine Rooms below and the early-20th century barbettes and emplacements for breech loading guns on the roof. (DP 097569)

Shell Filling Room

Another feature of the revised ammunition arrangements was that cartridges and barrels would no longer be filled at the battery but would be delivered from Woolwich made up and sealed in zinc containers (Moore 1996, 62). Consequently there would be only one specialised shell-filling room, for examining suspect cartridges and fuses, required at each battery. The increased complexity and volatility of the new cartridges would require more stringent safety precautions, with the filling room provided with work benches, handling hatches and a separate light passage. The construction of such a building at Cliffe is reflected in the letter dated 10 February 1872 from the CRE to the Inspector General of Fortification discussing the enlargement of the shell filling room at Cliffe and the ordering of additional wrought iron joists for the enlarged roof (TNA: WO30/108/101). A letter dated 12 April 1872 notes that these joists had still not been delivered (TNA: WO30/108/103).

Evidence to the 1869 committee (House of Commons 1869, Appx 4) included testimony that some works had very damp magazines causing woodwork to rot and condensation to form. The committee had recommended the substitution of asphalt for timber flooring and the frequent whitewashing of walls where it was impossible to ensure an adequate circulation of air. These recommendations were not adopted by the Thames forts as on 4 May 1872 a letter from the CRE to the main contractors reported dry rot in the stores and passage floors at Coalhouse. The letter went on to request that the installation of timber floors in the stores, shell rooms and passages at Cliffe and Shornemead be suspended forthwith (TNA: WO30/108/109).

A subsequent letter of 8 June 1872 discusses in detail the rising water at Coalhouse and its disastrous effect on the floor joists. The CRE recommends that all the Thames forts have the timber floors removed and replaced with asphalt laid on 6in of blue lias lime cement concrete over basements filled to the required depth with Thames ballast. Supplies of material were to be stopped for the soldiers' casemates

and gun casemates of the Thames forts (TNA: WO30/108/122), presumably whilst this was altered.

In a letter of 12 May 1873, Captain Newsome reported to the Inspector of Fortifications that the alterations to the basements of the Thames forts proposed in a memo of 12 March 1873 were now progressing (TNA: WO30/108/204). Examination of the sections of the basement stores on the 1899 record plan shows that this work was carried out. The brick walls of the stores and passages are drawn as extending 3ft below the current floor level and this gap is shown as filled with gravel and an approximately 1ft thick layer of concrete and asphalt, carried over the thresholds of doorways as a smooth slope (TNA: WO78/4963 plan No.5). However, the installation of solid floors in the basement was not the end of this problem:

> 17 June 1873
>
> Magazine fitments at the Lower Thames Forts
>
> Royal Engineers Office, Gravesend
>
> Sir,
>
> I have the honour to report that the walls of the basements of these forts are so damp that it would not be advisable to fix the wooden fitments, studding and battening of the magazines and shell rooms for some time to come and I beg to recommend that the execution of this portion of the contract should be postponed until next year - It is so manifest that these walls cannot commence drying out before the asphalt of the roof is laid and this service is not yet completed.
>
> (TNA: WO30/108/210)

It appears that, as often occurred in the Thames forts, the delay allowed the latest developments in equipment to be installed. On 14 December 1872 the CRE Gravesend wrote to the Inspector of Fortifications to enquire about the use of the new specification for magazine light boxes with brass frames and felt seals (TNA: WO30/108/172). The previous design of light box had used a quarter-inch thick sheet of polished plate glass set into an angle iron frame sealed with oil putty; inside the box was a lamp of four candles (Wilson 1963, 197). As usual the approval and delivery of these items took some time and it was not until 11 September 1873 that lamps, speaking tubes and brass lamp frames were included in a list of fitments required for the Lower Thames forts (TNA: WO30/108/245).

The Gorge Buildings

> The gorge of each work will be enclosed by a defensible work in connection with which part of the barrack accommodation will be provided (Jervois 1867, 123)

Captain H Silsoe, in his evidence to the 1869 committee about accommodation in the Thames and Medway forts, made it clear that the gorge buildings were intended primarily for ancillary functions: hospital, canteen, latrines and wash-houses for the garrison. The garrison would live in barracks during peacetime and in the casemates during wartime (House of Commons 1869, App 4).

It would appear that the gorge buildings at Cliffe were completed to more or less the original specification for the three forts. Problems with foundations at Coalhouse and Shornemead, where the foundations of part of the original battery were reused, meant that their gorge buildings differed from the proposed plan (Wilson 1963, 196). A letter dated 22 June 1872 shows that the gorge buildings were complete and their roofs ready to be covered in asphalt by this date (TNA: WO30/108/130).

Two pieces of correspondence discuss the measures incorporated in the gorge buildings to provide a defence against an infantry attack on this face of the fort. On 30 June 1871 estimates were invited for the construction of sea walls around the gorges of Coalhouse, Cliffe and Shornemead, placed 30 to 40ft from the gorge buildings where the rifle fire from their windows would sweep the slopes (TNA: WO30/108/58). The gorge at Cliffe would be 240ft long and 5ft high with 1ft 6in foundations, with the required earth delivered by barge and the clay for the slopes and counter-slopes dug out of the saltings. Study of subsequent Ordnance Survey maps does not indicate the presence of a gorge or sea wall although its likely course is followed by the tramway linking the creek jetty to the fort entrance. Either the slope and counter slope of the gorge were used as an embankment for the tramway or this is a later addition following the course of the earlier gorge. The second piece of correspondence is an estimate dated 29 October 1873 for the fitting of iron shields - presumably the loop-holed shields for riflemen provided for all the Thames forts (Wilson 1963, 186) - to the sash windows in Cliffe Fort. At a cost of £6 10s per shield, and a total cost of £71, this equates to 11 shields, enough to cover the windows in the east face of the fort (TNA: WO30/108/254).

Tramway and jetties

Correspondence about deliveries of materials and stores such as the frames for the armoured shields shows that the majority of items reaching Cliffe did so by barge along the Thames. The material and supplies department at Woolwich Arsenal was fully equipped for moving supplies along the river and even had two specialist barges, Gog and Magog, for the carriage and unloading of the RMLs for the coastal forts (Hogg 1974, 100). An article in *The Times* dated 21 May 1877 (p 6) reports that one of the 38 ton RMLs slipped from Magog while unloading at the Cliffe pier and a special detachment from Woolwich was dispatched to help haul the barrel from the mud on the foreshore. It is not surprising that supplies were delivered by river, as a report from the CRE dated 1 September 1870 describes the roads around Cliffe as of poor quality (TNA: WO30/108/56).

The creek jetty at Cliffe was in existence by 1866 when Edward Ball, the caretaker to the fort, was paid an additional 6s a week for lamp lighting on the jetty. In December 1869 there was discussion about the retention of his services as work on the site had recommenced and a Foreman of Works was to be appointed (TNA: WO30/106/159). The importance of the jetty is indicated by the response to a letter dated 12 December 1869 ordering his dismissal (TNA: WO30/106/161). This was temporarily withdrawn when the continuing need for lamps on the jetty was highlighted (TNA: WO30/106/162; WO30/106/158).

Correspondence demonstrates that a picket boat service connecting the construction sites of the three forts with Gravesend existed and provided the most practical way to move personnel and visitors around the sites. An order dated 3 September 1877 reminds officers not to keep the picket boat crew over dinner time and that instructions for the Coxswain must reach the Gravesend RE office by 9.30am each day (TNA: WO30/108/201; REL GA/0/9). Estimates for 1873 included a further £10 for the maintenance of the creek jetty for Cliffe Fort (TNA: WO30/108/254).

The creek jetty was connected to the fort by a tramway. This is shown and labelled on an annotated Ordnance Survey 1:2500 plan of 1918 (TNA: WO78/5134), but the depiction of Cliffe Fort with only a single Brennan launch way and no additional buildings on the parade ground suggests that this plan is based on the Ordnance Survey published 1897 (surveyed 1895). The tramway extends eastwards from the jetty running just to the south of the fort glacis. It runs across the south face of the fort, curves around the south-east bastion and terminates at the entrance. An earthen bank which appears to branch from the tramway before petering out near the north-east bastion does not appear to be directly related.

The road across the saltings

On 21 April 1870 an appreciation of the situation concerning the road between Cliffe and Shornemead was prepared by the CRE Gravesend.

> At the moment the route from Cliffe to Shornemead takes six miles by the existing roads rather than one and a half across the saltings. CRE has consulted with the owners of land and houses along the coast line and they would be amenable for the driving of a road between the two places. (TNA: WO30/108/35 and 36)

He added that a road would be tactically desirable as the present roads were of poor quality and would be flooded if the sea wall was cut. He suggested that the new road should be 15ft wide and on a causeway.

On 4 October 1870 an application to tender for a proposed causewayed road following the sea wall between Shornemead and Cliffe was issued. The War Office would pay for its construction but it would be maintained by the landowners with a stipend paid annually by the War Office (TNA: WO30/107/218). The intention to build a road to Cliffe was certainly clear on 30 June 1871 when estimates were invited for construction of sea walls around the gorges of Coalhouse, Cliff and Shornemead (TNA: WO30/108/58). The specification notes that the road into the forts would have to bridge the gorge and walls and suggested that the road was completed after all the work in the forts was finished. The delaying of the road until the fort was finished seems to have been adhered to as, on 31 October 1873, the CRE was still requesting the building of a metalled road across the marshes to Shornemead. In his letter he raises the supplementary argument that communications would be important if Shornemead was used for volunteer camps or as a torpedo establishment (TNA: WO30/108/256).

The road was eventually constructed. The 1897 (surveyed 1895) 1:2500 Ordnance

Survey map shows the course of a footpath on a causeway across Higham marshes and the Cliffe saltings. This footpath begins in the white space left by the redacting of Cliffe Fort from the Ordnance Survey map and ends at the white space left by the same measure applied to the depiction of Shornemead Fort. Although a footpath still runs between the two forts, it is clear that the 1871 footpath has been either destroyed or buried by later flood defence works.

Changes in armament and mountings before completion

Moncrieff Mountings

As discussed, by 1869 the plans to arm Cliffe Fort with two tiers of smooth bore guns and an iron-covered casemated work of 20 or so RMLs had been abandoned due to developments in artillery and armour-plating, and doubts about the structural strength of the Thames forts.

The committee of that year went into great detail about the proposed armament of, not only the Thames forts, but all the works proposed under the 1859 report (House of Commons 1869, Appx 1). The Thames forts were examined in particular detail due to the slow progress and the concerns about their structural strength. Colonel Jervois presented to the committee his three armament options:

- Option A would see 20 guns mounted in iron-shielded casemates
- Option B would see seven guns in iron casemates and six in Moncrieff disappearing positions
- Option C would mount 10 guns in granite-faced casemates alternating with seven guns in Moncrieff pits

All options would mount 10-inch 18 ton RML guns. To assist the committee Captain Moncrieff was given a draft plan of the options as applied to Cliffe Fort and allowed to visit the Thames works before reporting to the committee on 19 April 1869 (House of Commons 1869, App 2).

His report made four points. First, the raising of the parapet to accommodate the Moncrieff mountings would make Cliffe Fort the most prominent object in the landscape and an obvious target. Second, enfilade long-range fire from warships on the Thames could take the positions proposed in options B and C in the rear where the Moncrieff mountings were most vulnerable. He doubted if the structure at Cliffe could support the substantial earthwork parados needed to protect the guns in this situation. Third, both options B and C negated the main advantage of the Moncrieff mounting which was concealment. To place the mountings low enough for them to be invisible from the river they would either have to be placed at the rear of the casemates, which would have to be filled with concrete, or in a new work. Fourth, options B and C would both require extensive reconstruction of the existing basement and casemates and he strongly advised against combining casemates and disappearing mountings in the same work – 'one does injustice to the other' (House of Commons 1869, App 2).

Despite Captain Moncrieff's obvious doubts the committee were keen on the Moncrieff system as it provided an economic solution to the structural problems of the Thames forts (House of Commons 1869, App 2). The continued determination of the committee to adopt this system is illustrated by a letter of 19 July 1869 in which the CRE was requested to submit to the Inspector of Fortifications suggestions for the revision of the design of Cliffe Fort to accommodate the Moncrieff system of mounting guns (TNA: WO30/106/119). The possible economies of adopting the system were detailed in *Statement relating to Fortifications: June 1869, Alterations in estimate produced by the adoption of the Moncrieff system of mounting guns* (House of Commons 1869, App 3). Coalhouse exhibited a net saving of £82,365, Cliffe £57,216 and Shornemead £57,216 when set against the projected costs of iron shields (£106,123) but excluding the cost of the Moncrieff mountings (TNA: WO30/106/127). However the argument over the precise method for mounting the Moncrieff carriages continued between the committee and its secretary Colonel Jervois and Lieutenant Colonel Gordon, CRE Gravesend:

> 23 Sept 1869
>
> Memorandum for the commanding Royal Engineer at Gravesend with reference to the letter of the 17th inst relative to the completion of Cliffe Fort
>
> The CREs proposal for the construction of gun pits will as requested by him, be considered to be withdrawn
>
> The CRE is requested to state in detail, the reasons which induce him to prefer the project for placing the guns at Shornemead and Cliffe behind the basement in preference to placing them on top of the basement –
>
> And if the CRE concurs it is proposed to proceed with the partial excavation of the glacis, and with the drainage and the sea walls of the forts. The return of the enclosures is requested.
>
> W.F. Jervois
>
> (TNA: WO30/106/138)

Subsequent correspondence shows that this argument continued throughout 1870, dogged by continued serious technical problems with the Moncrieff system, not least its inability to mount anything larger than a 7-inch RML successfully (Moore 1996, 26). In 1871 Gordon evidently lost patience with the whole affair:

> Thames Defences: Moncrieff portions of Coal House, Cliffe and Shorne[sic] Forts
>
> Royal Engineers Office, Gravesend, 5 Aug 1871
>
> Sir,
>
> Certain portions of the Forts at Coalhouse, Cliffe and Shornemead intended for guns mounted on Moncrieff carriages are ordered not to be gone on with until further instructions are received and I have the honour to inform you that the contractors are seriously

hampered by the delay they have had to submit to.

You will observe upon the accompanying (illegib) upon which they are distinguished by a red line, that the space these portions occupy is precisely that where rapid fire would be most invaluable and where perfect safety to the gunners with references to this advantage has (illegib) to be considered than in any other parts of the forts in as much as no ship would (illegib) stop to engage these batteries á vis to them.

I would therefore suggest reconsideration of the design for guns on Moncrieff carriage for the three forts on the grounds that a more efficacious and rapid fire could be manufactured by guns mounted on ordinary carriages at the most critical moment of an enemies passage.

However successful the Moncrieff system of mounting heavy guns may, probably, will eventually become it seems doubtful of its worth while delaying the Thames defences until it is perfected.

I have the honour to be, Sir, your most obed[ient] servant C.H Gordon Lt. Col. RE (TNA: WO30/108/79)

An accompanying hand drawn chart makes it clear that the intention was to mount the Moncrieff carriages in the west-facing section of the fort where casemates 10 to 14 and the open battery were eventually constructed (TNA: WO30/108/79).

The letter was accompanied by a report from the Artillery Officers group on the progress on Moncrieff carriages and their use in the Thames forts.

Report of the officers CRA and CRE at Gravesend on the Forts at Cliffe, Shorne and Coalhouse

Gravesend Aug 14 1871

In consequence of the request of the Director of Works dated 9 Aug 1870 to the CRE directing that officer to confer forthwith with the officer CRA on the subject of the formers suggestion to substitute guns on ordinary carriages for those proposed to be on Montcrieff carriages the undersigned visited the above Forts together and they are of the opinion seeing the delay that is likely to occur in the perfecting of the Moncrieff carriages which delay retards the completion of the Thames Forts and also that no advantage appears to be gained by having guns on Moncrieff carriages in the positions designated in W.O Plans that it would be preferable to substitute for these guns –

At Coalhouse	3 18 ton guns behind shields
	3 ditto in open battery
At Cliffe	2 ditto behind shields
	3 ditto in open battery

At Shornmead	1 ditto behind shield
	3 ditto in open battery

(TNA: WO30/108/81)

It would appear that, at the end of 1871, Gordon had won his battle and the Moncrieff proposals were withdrawn to be replaced by conventional casemates and iron shields. A letter requesting a quote for the landing and erection of four additional shields at Cliffe was sent to Aird & Sons on 8 January 1872 (TNA: WO30/108/93). Their reply on 25 January provided a tender for the contract and noted that it should be done to the specification established on 1 June 1871, suggesting that this was when the first iron frames were installed (TNA: WO30/108/93). The attached tender was only for the delivery and installation of the wrought-iron riveted frames that held the armoured plate in the embrasure. It was not until 21 November 1872 that the two tenders for landing and fixing the armoured plate at Coalhouse, Cliffe and Shornemead forts were accepted (TNA: WO30/108/163). Work was further delayed by the slow production of the shield frames at Woolwich and the delivery of mantlet bars (wrought iron bars for suspending rope curtains inside the armoured shield to protect the gun crew from shrapnel) without any accompanying paperwork to show which of the three Thames forts they where intended for. A letter of complaint was sent to Lieutenant English, the officer responsible for design and production of ironwork (shields, bars and loops) at Woolwich and subsequently the construction of the Medway forts (TNA: WO30/108/147; Wilson 1963, 180).

Work on the fort's mountings and armament continued throughout 1872 and into 1873. On 4 July 1873 the CRE wrote to the CRA stating that the fort was not yet ready to receive its armament (TNA: WO30/108/220). The first official reference to the Thames forts being armed is in the 1876 *Annual Distribution of the Army* although only in the column 'RML 7-inch and Higher' so the precise mounted armament at this date is not known (Wilson 1963, 186).

Mine (Torpedo) Installations

The 1860 Royal Commission report had recommended placing a floating barrier across the Thames between Coalhouse Point and Cliffe Creek in time of war (House of Commons 1869, App 1). Experience of the American Civil War (1861-1865) and recent technical developments in explosives and electricity provided a new method, a controlled minefield (then know as 'torpedoes') to restrict passage along the Thames.

A letter from the CRE Gravesend to the Inspector of Fortifications dated 12 August 1873 shows that such a scheme had been under consideration since April 1869, when charts had been prepared for proposed 'torpedo' sites along the Thames. Discussion of water tanks for storing electrical cable, and the location in the Thames forts of firing points and stores, shows that the scheme was under active consideration. The conclusion was that Coalhouse Fort, at the centre of the area, seemed to be the best positioned as the firing and observation point (TNA: WO30/108/233).

The scheme was eventually carried out with Shornemead adopted as the base for a Submarine Mining Establishment (TNA: T/1/16171). Shornemead's adoption over Coalhouse may reflect doubts expressed in the April 1869 report concerning the security of the Essex side of the Thames from an invading enemy (House of Commons 1869, App 3). The need to restrict an attacking warship's passage around Hope Point was not forgotten: provision for a boom was retained and this was eventually reinforced by the installation of the Brennan torpedo battery at Cliffe.

The Operational Armament

As has been illustrated, delays in construction and arguments over the armament to be adopted meant that the Thames forts were overtaken by three advances in military technology before their eventual commissioning sometime around 1876, the increasing calibre and size of RML guns being the final advance following the move from smooth bore to rifled guns in the late 1860s and the abortive work on the Moncrieff system.

To replace the Moncrieff mountings the joint report of the CRE and CRA Gravesend of 14 August 1871 (TNA: WO30/108/81) had recommended five additional 18 ton guns and it is assumed that these would be the 18 ton 10-inch RMLs listed in earlier reports. The letter of 11 September 1872 concerning mantlet bars (TNA: WO30/108/145) confirms that weapons of this calibre or above were intended as the main armament for Cliffe Fort as mantlet bars were only provided for gun positions for the calibre of 10in or above (Moore 1996, 29). The slow progress of the work on the shields, mantlet bars and casemates suggests that the opportunity was taken to install the new 25 ton 11-inch RML in place of the 10-inch RML. The 11-inch was a broadside weapon and, firing armoured-piercing shells, it was able to take on contemporary warships. Its widely used Mark II form was introduced to service in 1871 so supplies should have been available from Woolwich in 1872 or 1873 (Hogg 1974, 103).

At Cliffe Fort the nine 11-inch RMLs (and all the other calibres of RMLs here) were mounted on an inclined gun carriage on a casemate platform with an 'A' pivot mounting. In this mounting the pivot did not physically exist. It was an imaginary centre point in the mouth of the embrasure from which all the crucial dimensions for the setting of the traversing racers could be calculated (Moore 1996, 29). The flanged steel racers formed curved tracks laid in the floor of the gun position on which wheels in the carriage ran. The weight of the gun required mechanical aids for traversing and the carriage incorporated a winch at the opposite end to the muzzle, connected by a drive chain to a toothed wheel beneath the carriage which engaged in the slotted track of the outer racer. The gun and carriage could be traversed by turning the winch handles (Moore 1996, 29).

Ammunition in the form of cartridges and shells reached the guns via winches and pulleys placed at the top of shafts cut through the floor of the battery and the vault of the basement. At Cliffe, Shornemead and Coalhouse the tops of these shafts are positioned against the face wall at the front of the casemate delivering the ammunition to the front of the gun. Contemporary forts mounting similar ordnance

such as Gilkicker (Gosport) and Landguard (Felixstowe) have the hoists at the rear of the casemate delivering the shell and cartridge to the rear of the gun were they would be brought forward by the loading numbers when required (Moore 1996, 29). The adoption of the alternative system at the Thames forts must have been for a good reason; as installed all the ammunition is delivered to the cramped working area in front of the gun where it has the potential to get in the way of the crew trying to clean and reload a large muzzle loading gun in the confines of an armoured shield.

The 12.5-inch 38 ton RMLs

Wilson (1963, 187) reports that the intention was to provide two 12.5-inch RMLs for each of the Thames forts; he quotes from the footnotes of the 1876 Defence Committee Report that the reason for mounting two 12.5s at Cliffe and four 12.5s at Coalhouse was 'to give fire upon ships as soon as they had passed the Mucking Light'. The range from Cliffe Fort to Mucking flats, which is to the north-west of Cliffe Fort on the Essex bank of the Thames, opposite Hope Point, is 4.56km (2 1/2 miles). Both the 11-inch and the 12.5-inch RMLs had similar maximum ranges (4000 to 6000yds) but the 12.5 fired a heavier shell over this distance (Hogg 1974, 104). The two 12.5s intended for Shornemead were diverted to Coalhouse as the former was judged poorly placed and probably too structurally unstable for such weapons (Wilson 1963, 187).

Wilson (1963, 187) adds, 'The Director of Artillery and Stores wrote in March 1877: the six 38-ton guns required for the Thames forts are to go this month, and all the guns of that type required everywhere should be mounted before the end of 1877-78'. The article in *The Times* from 21 May 1877 (p 6) reporting the dropping of a 38-ton RML into the Thames while unloading at Cliffe from the gun barge Magog on 14 May confirms that the 12.5-inch RMLs were installed at Cliffe around that date. Wilson further comments that mounting the 38-ton guns in the already completed casemates of the two forts would have been quite a feat using just rope tackle, rollers and timber skids. This and the need to have the arcs of fire open to the Mucking Light to the north-west may explain the position of the two 12.5-inch RMLs at the north-east end of the battery at Cliffe as shown on the 1899 record plan (TNA: WO78/4963, App Fig 2).

The 9-inch RMLs in the Open Battery

The first mention of an open battery at Cliffe is in correspondence regarding the abandonment of the Moncrieff proposal. This would have provided up to seven guns in open pits, covering the bend of the river, in addition to three or four guns mounted in casemates. The proposed alternative to the Moncrieff mountings was to place two guns in shielded casemates and three in open battery (TNA: WO30/108/81). The reason for initially recommending the installation of three guns in open battery is discussed in Gordon's letter of 5 August 1871 (TNA: WO30/108/79). His argument against the Moncrieff proposals emphasises the need for rapid fire from the guns trained on the bend of the river. Guns in Moncrieff pits and in the casemates would be incapable of following a fast-moving target and sustaining rapid fire. A smaller gun in an open battery was required. This was reflected in the armament of the fort

when it was eventually completed, 11 guns (nine 11-inch RML and two 12.5-inch RML) in casemates and two 9-inch RML in open battery, all on 'A' pivot casemate platforms (TNA: WO78/4963; App Fig 2).

The 9-inch RML was introduced in 1865 and went through four marks reflecting changes in the method of construction. It was the largest RML that could be loaded, trained and fired by hand (the larger calibres required carriages with mechanical advantage for traversing). The carriage could be traversed either by hauling on ropes and pulleys attached to iron rings in the walls of the emplacement or by the gun detachment with large timber levers called gun spikes. It could be mounted on a variety of carriages but all the battery positions required a step at the muzzle end to assist the loading crew with placing the shell and cartridges into the muzzle of the gun (Hogg 1974, 102). For Cliffe, Coalhouse and Shornemead the 9-inch RML was on the A pivot mounting but with wrought-iron flanged racers set at 6ft 6in at the front and 16ft 6in at the rear (Moore 1996, 23). Scaling from the depiction of the single remaining 9-inch RML position shown on the 1899 record plan (the other position had been converted for the Brennan torpedo installation) shows that the dimensions for the slides and pivot were set to these measurements (TNA: WO78/4963).

In common with the 11-inch RML battery the installation of the 9-inch RMLs took some time. It can be assumed that they were in commission by 1877 along with the rest of the Cliffe Fort armament. They were not installed by 1873 as the following letter dated 7 March illustrates:

> To the clerk of Works Coalhouse and the military foreman Cliffe and Shornemead.
>
> With a view to preventing wet percolating into the basement from the joints between the gun racers of the open embrasures and the chalk pavement it is considered necessary to lay flooring of asphalt under the bearers of the racers turned up to the level of the pavement.
>
> (TNA: WO30/108/188)

Asphalt could not be laid under the racers if the gun was already in position on its carriage.

The Garrison

Cliffe Fort was officially completed on 26 or 27 October 1874 when Sergeant Major Chimes was dispatched from the Gravesend RE office to make a final inspection of the works and then to accept the keys from the contractors; a week earlier Major Newsome had been dispatched to Woolwich to consult as to the manning and operations of the Thames forts (REL GA/0/9).

The scheme for manning the fort is reflected in a report of 1887 in which the Inspector General of Fortifications wrote that few of the modern forts throughout the whole country had garrisons, and that it would be a serious problem to man

them in an emergency (Wilson 1963, 146). A table in the Intelligence Report for 23 September 1866 in War Office papers shows that of an allocated garrison of 2,476 artillerymen for the Thames forts there were actually 142 men, all of them quartered at Tilbury (Wilson 1963, 145). The defences were kept in order by small care and maintenance parties of old or ex-soldiers under the supervision of a senior NCO (Non-Commissioned Officer) as master-gunner of the particular fort (Hogg 1974, 115).

The 1881 census return suggests that such a body of men was quartered at Cliffe Fort (www.findmypast.co.uk 1881 transcript details for Cliffe Fort, Cliffe at Hoo, Kent). All of the men listed, including three men with families, were in their late 30s or early 40s suggesting that they were long-serving and experienced artillerymen. Sergeant Bunger was the sole senior NCO and likely to be the master gunner in charge. The birth places of the children of Gunner James Chambers show that he had moved around some of the major garrisons of the British Empire. There is an interesting coincidence between the suggested date of 1876/1877 for the fort's commissioning and the birth of several children at the fort in 1877, suggesting that a number of families had moved into the fort shortly after it had been commissioned.

The entries in the 1881 census return, Cliffe Fort, Cliffe at Hoo, Kent are as follows:

> Sergeant William Bunger a Royal Artillery sergeant, his wife Margaret a certificated national school teacher and four young sons, three of whom were born in the fort, the oldest of these in 1877;
>
> Gunner James Chambers, Jane his wife and three sons and two daughters, the youngest son and daughter, aged 2 and less than 1 year old respectively had been born at the Fort. The others had been born in Ireland, Aldershot and the West Indies, witnesses to the peripatetic life of a Victorian gunner;
>
> Gunner John Skinner, Ellen his wife and two daughters both born at the Fort in 1877 and 1881;
>
> Gunners Michael Castey, Thomas Draper, John Farthing, Robert Francis, John Gormlay, Thomas Phillips and Henry Smith
>
> (www.findmypast.co.uk 1881 transcript details for Cliffe Fort, Cliffe at Hoo, Kent).

6. THE FORT AROUND 1870: THE BASEMENT

NB The numbers in square brackets in the text were assigned by the authors and refer to the internal spaces of the fort as numbered in Appendix Figure 4 and Appendix Figure 5. Measurements given in metric first were taken at the time of survey, those given in imperial first come from documentary sources.

The long gestation of Cliffe Fort took it through a period of radical developments in coastal artillery and associated ammunition storage and supply arrangements. As initially conceived, it can be assumed that Cliffe would have had a similar arrangement to Grain Fort, a large central magazine buried under the counterscarp and ammunition carried back to the parade ground and then hoisted up to the guns (Wilson 1963, 155). It is unlikely that this arrangement was ever constructed at Cliffe as its shoreline location and the condition of the ground would have made a large underground magazine impractical.

Work began on the construction of the basement at Cliffe in 1865 and in the report that was made to Parliament in 1867, it was reported as finished by February of that year (Jervois 1867, App 3). This might have been an economical truth. It is likely that the brickwork of the casemates was completed but little else and between 1869 and 1874 there is copious correspondence regarding the completion of the basement. This includes an account of sums allowed for modifications to the shell lifts and later letters concerning fixtures, fittings and the rising water level.

Plans for ammunition stores for use with the new RML guns, which fired cartridge charges and fused shells, rather than the loose powder and shot of their predecessors, were being developed at Woolwich and were included in the 1869 report to Parliament (House of Commons 1869, App 3; Wilson 1963, 143). The underlying principle was that the cartridge and the shell should be handled separately and then take different routes to the gun. It was recommended that the cartridge should go to the muzzle end of the gun (the front) and the shell to the rear where it would be manhandled to the muzzle end in a special trolley. This would be reflected in the layout of the stores at basement level with the cartridge stores opening onto a powder (cartridge) passage at the front of the battery and the shell stores opening onto a parallel shell passage to the rear. Immediately adjacent to the shell passage would be a light passage providing access to the lights which were placed behind windows set in the walls of the stores and passages. How the cartridge passage would be lit is not made clear in the guidelines. It was recommended that the shell and cartridge passages should be 15ft (3.5m) wide and the light passage 3ft (0.98m) wide.

The amount of space required for all three passages and the interlocking stores and magazines is certainly not available in the basements of Cliffe, Shornemead and Coalhouse and the plans of all three exhibit the same compromise towards the 1867 instructions. The shell and cartridge passages are combined into the single annular shifting passage running at the front of the magazines, all the ammunition reaching the guns via lift shafts pierced through its vault and emerging at the muzzle end of the guns. The lighting passage was constructed in the recommended position and at the stated width of 3ft but lights the stores and passages via magazine lights set in the rear wall of the stores and via transverse lighting passages.

Close examination of the fabric of the basement at Cliffe, and in particular the entrance passages, the light passages and the entrances to the stores, shows that the layout depicted on the only comprehensive plan of the basement dated June 1899 (TNA: WO78/4963; App Fig 1) is not original and has been altered at some point in the fort's development, particularly, the lighting arrangements in the stores and passages. The alterations will be described below (Fig 6).

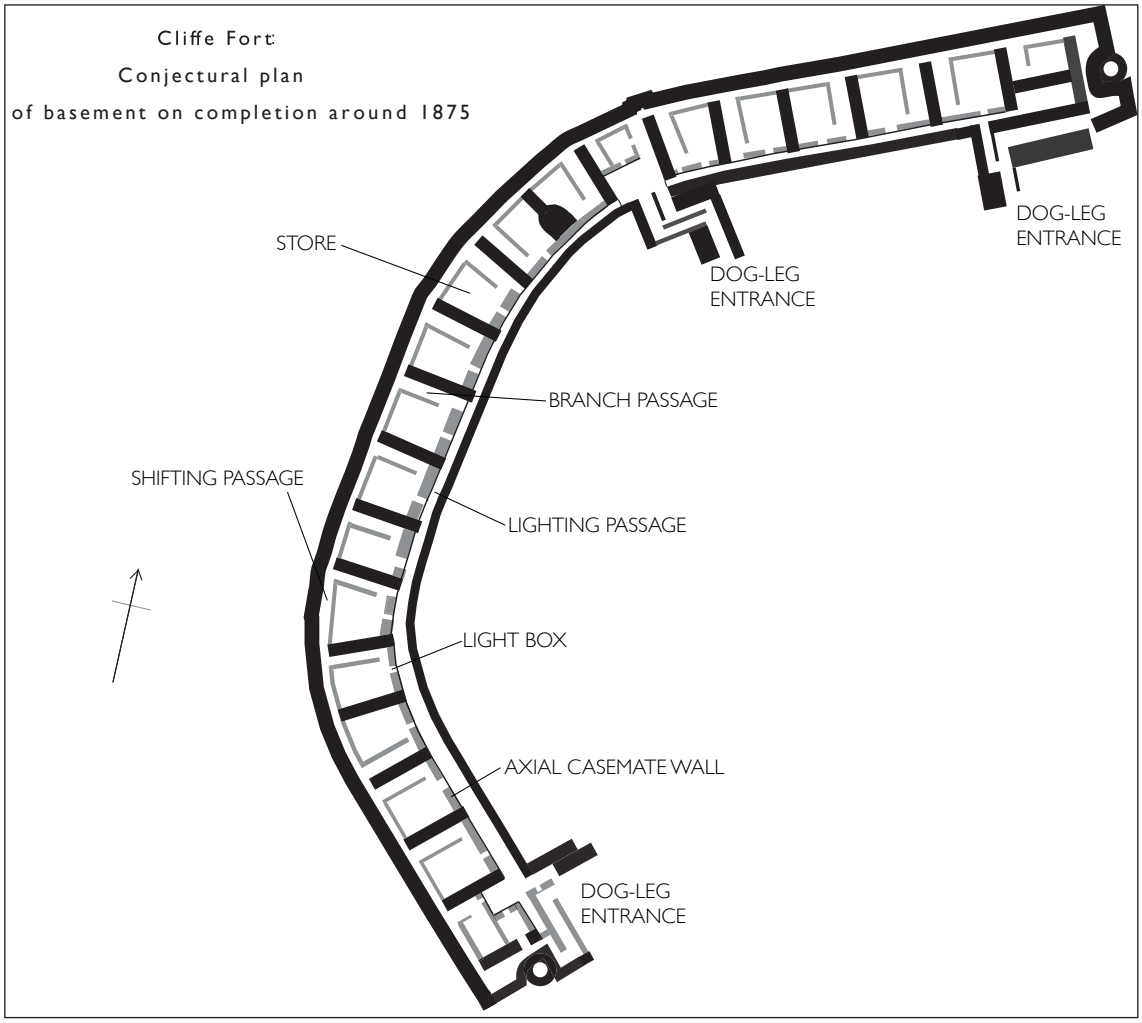

Figure 6: Conjectural plan of the basement as it would have appeared on the completion of construction work in 1875, based on the 1899 plan (TNA: WO78/4963; App Fig 1) and examination of the basement fabric (Not to scale).

All the stores and passages in the basement are labelled on the 1899 plan but only in relation to their use at this date (TNA: WO78/4963; App Fig 1). By 1899 the battery had been extensively modified with four 11-inch guns removed and their positions converted into traverses. The 9-inch open battery had been reduced to a single gun, the position of the other being rebuilt as part of the Brennan torpedo installation. This installation had required the rebuilding of the basement beneath the former gun

position and this area is not shown on the 1899 plan. Some of the stores had been rebuilt for ammunition supply to the new quick-firing guns mounted on the battery roof. An earlier skeleton drainage plan of Cliffe dated 1891 with revisions from 1893 (TNA: WO78/3427) does not show any detail in the casemates but indicates the entrance passages to the basement in the south-west corner, north-east corner and mid-way between the two. Since Cliffe, Coalhouse and Shornemead were constructed at virtually the same time and to the same specifications, the plans of the other two forts - particularly the section and record plan of Shornmead Fort both dated 1887 (TNA: WO78/4369; WO78/2601/11), along with a set of record plans for Coalhouse Fort dated 1897 (TNA: MPHH171/1) - can provide information on how the Cliffe magazines developed.

The basement of the battery extends between the face (front) wall and rampart (rear wall) and is divided into 20 casemates and two passages by 21 English Bond axial walls 4ft (1.2m) thick. A brick-built segmental-arched vault extending over each casemate springs from these walls. The front (west or north) of each arched casemate is blind, the arch being closed by a further brick wall, and these combine to form the inner leaf (a lining) to the 14ft (5.0m) thick masonry ragstone wall that forms the face wall of the basement and the foundations for the casemate embrasures and shields above (TNA: WO78/4963; App Fig 1). Running parallel to this brick wall is the shifting passage, a curving passage originally running the entire length of the battery face wall. This passage passes through each of the axial casemate walls beneath shallow segmental arches, the heads of which are composed of five or six header courses. Presumably for strength, the arches splay to each side as they meet the brick face wall giving the effect of intersecting vaults progressing along the passage. The spacing of the axial walls varies at the south end of the basement, below the 9-inch RML open battery, reflecting its different construction.

Three quarters of each casemate is occupied by a shell or cartridge store. The majority of stores now have their entrances opening directly from the shifting passage, through doorways with sandstone lintels. A minority have entrances at the end of a branch passage which occupies the remaining quarter of the casemate running southwards or eastwards from the cartridge passage. In these cases the doorways have two or three course segmental heads.

Running parallel to the rear walls of the stores is the lighting passage, another vaulted curving passage, noticeably smaller (3ft) and lower than the shifting passage. The roughly quarter segmental vault of this passage springs from the substantial brick built wall that retains the rampart and ends butted against the rear wall of the casemates. Running northwards from this passage and occupying the remaining quarter of the casemates are branch lighting passages serving magazine lights set just below the springing line for the vault of the shifting passage. The lights are accessed by a flight of steps set in a dog leg at the end of each branch lighting passage.

Of interest, and only fully visible on the 1899 plan (TNA: WO78/4963; App Fig 1), are three backfilled shafts: one halfway along the basement and the others at the north and south ends of the battery. Their presence is indicated by curves in

the walls of the end passages and the respective east and west walls of No 10 Shell Store and No 9 Cartridge Store [97 and 98]. Comparison with other works such as Fort Gilkicker, Gosport (www.fortgilkicker.co.uk accessed 25.01.2011) and a contemporary description of Garrison Point Fort, Sheerness (Anon 1876, 419) show that they were intended for spiral staircases running between the basement and the gun floor. The lack of any visible evidence for doorways in the basement, or for the timber boxing that should mark the head of the stair at gun floor level, as at Fort Gilkicker, strongly suggests that the shafts were never used for their intended purpose.

Entrance passages

Currently entry to the basement from the parade ground is via three sets of passages, one in the south-west corner, one in the north-east corner and another placed between the two though closer to the north-east entrance. They perform two important functions: a changeover point between the body of the fort, termed dirty areas, and the clean areas inside the ammunition stores and passages; and the protection of these areas from ricochet by enemy shells. These functions are reflected in the complex arrangement of dog-legs and lobbies incorporated in the passages. The dog-leg course incorporates traverses and forms a chicane to stop enemy shells from entering the ammunition stores. The lobbies and adjacent passages provide the transition between the clean and dirty areas which included a door or barrier between the two. In the lobbies clothing was changed, pegs and benches being provided for the purpose, and any item that could strike a spark and thus cause an explosion was removed before entering the magazine. The rigid separation of the stores and shifting passages from the light passages and boxes was enforced for a similar reason.

South-West Entrance

Investigation of the three surviving entrances into the basement shows that the passageway in the south-west corner, beneath the 9-inch open battery, is the only one that still matches its depiction on the 1899 plan (TNA: WO78/4963; App Fig 1). Comparison with plans of Coalhouse Fort (TNA: MPHH171/1) suggests that the original basement arrangement survives in the south-west corner of Cliffe Fort. The interior of these stores and passages is relatively undisturbed: free of rubbish, graffiti and retaining some fixtures and fittings, notably the timber barrel stave guides to the mouths of the ammunition hoists. However, survey in this area was restricted due to the presence of bats.

The shell and cartridge stores in this corner were built for the 9-inch RMLs in open battery but, other than a variation in the arrangement of the ammunition hoists, they follow the general layout of the stores for the larger calibre weapons elsewhere in the fort. Access from the interior of the fort to the stores is through a single open passage in the south-west corner of the south-west bastion. The south wall of the passage is formed by the front wall of the two barrack stores (see Chapter 8) and the north by the riser wall for the stair leading to the southern end of the open battery. The 1899 plan (TNA: WO78/4963; App Fig 1) shows that the void below the stair

treads is filled with rubble and concrete creating a traverse for the passage. As the passage passes below the rampart wall it bifurcates: to the west a doorway opens via a dog-leg passage into the shifting passage, in the north wall a doorway, noticeably smaller than the west doorway, opens into the lighting passage.

The entrance to the shifting passage retains sections of door frame which, along with witness marks in the vault, show that the passage had a pair of outward-opening doors. Through these doors was a lobby lit by a magazine light in the north wall. From this lobby the passage heads south incorporating the transition from the dirty to clean area. At the south end of this section are the remains of a frame for a control barrier and on the west wall of the passage are a row of copper nails, the location of a backboard for clothes hooks.

Beyond the barrier the passage turns back towards the north past the projecting curved wall of the staircase shaft. It then emerges into an east-west passage with, in its north wall, the entrance to a small whitewashed, vaulted room with a magazine light in its north wall. This room is described as a cartridge store on the 1899 plan (TNA: WO78/4963; App Fig 1). Similar sized stores in approximately the same position on the Coalhouse plan (TNA: MPHH171/1) are labelled as 'Lamp Room'. However the room at Cliffe cannot be a lamp room as it has direct access from a shifting passage and the lamps and ammunition were kept separate. Beyond this the passage describes another 90 degree turn and joins the main shifting passage.

The doorway to the lighting passage [59] is beneath the stair to the open battery. Holes in the jambs of this doorway show that a single stable door closed off the passage from the body of the fort. Once inside, the passage then proceeds west until it opens out into a vaulted recess formed by walls on the north, south and east sides. Plans of Shornemead and Coalhouse (TNA: WO78/4963; MPHH171/1/2) show similar areas (labelled as 'lamp room' on the Coalhouse plan) formed either in breaks in the passage wall or by setting back the rear wall of a casemate to give a shorter store and create a small enclosed area on the lighting passage side. The Coalhouse plan shows timber benches in these areas, probably intended for the storage and the trimming of lamps. No such room or recesses are labelled on the Cliffe plan, the only labelled Lamp Room is located outside in the rampart on the north side of the Laboratory, equally inconvenient for all three routes to the lighting passage suggesting this was not its original location. The Cliffe recess also serves magazine lights placed in the west and south walls for the adjoining cartridge stores. The magazine lights are of the standard design for Cliffe, other than the one in the south-west corner, lamp recess 36, skewed to enter the north-east corner of the adjacent No 18 Cartridge Store [57], which has a bespoke timber frame.

Beyond the recess the lighting passage continues to the north. In its eastern wall is a vent: a rectangular recess in the wall with the remains of a wooden frame leading to a lead-lined circular flue which emerges on the top of the rampart hard against the east face of the open battery traverse. The main light passage would have continued through what is now the Brennan torpedo area into the rest of the basement but now ends in the branch light passage to the north of No 17 Shell Store [58]. At the end of this passage, in the south wall, a segmental-headed blocked opening may indicate an earlier entrance into No 17 Shell Store [58].

Intermediate Entrance [95]

The entrance to the intermediate passage has the same form as that to the south-west. The stair to the top of the rampart forms a traverse on its west side while the east side is a substantial brick retaining wall, now the west wall of the dynamo room [70, 71]. This passage then bifurcates as it passes beneath the rampart with an entrance to the shifting passage to the north and an entrance to the lighting passage in the west wall. The lighting passage has an irregular semicircular brick vault and is entered by a doorway beneath an arched head. After describing a dog-leg it emerges in the main light passage beneath an arched head to the west of the shifting passage entrance.

The shifting passage has an arched entrance, within which an inner arch forms a rendered setback indicating outward opening doors; holes in both jambs indicate the position of timber that retained the door frame. Through the doorway the passage turns immediately west. In the wall opposite this doorway is a blind archway with a near semicircular head. Rather than indicating a blocked entrance this archway seems to be illustrative of the simple construction of these passages with the corners formed from straight intersections rather than complex vaulting. Immediately to the south of this archway is another door frame intended for a pair of doors to close off the head of the east-west passage. This doorway is inserted: it is not indicated on the 1899 plan (TNA: WO78/4963; App Fig 1) and the doorhead is accommodated in a slot cut into the brickwork of the vault. The doors would have opened back into the passage sitting flush in square-headed recesses which are also cut into the vault. Beyond this point, in the south-west corner where the passage turns north, two triangular sandstone slabs are set neatly into the walls forming the base and lintel of a lamp recess (No 14) angled to light both legs of the passage. The brick course immediately below the lintel is covered by render suggesting that the lintel and sill are also later insertions. A neat rebate for a frame has been cut through the brick courses to match a rebate in the sill and lintel (see Fig 7).

The shifting passage emerges into a four-way junction; it continues towards the main, curving, shifting passage but is intersected by the main lighting passage running east-west (Fig 7). It is clear from the brickwork around the entrances and within the passage themselves that both are contemporary. The 1897 plan of Coalhouse Fort (TNA: MPHH171/1) shows that the light passage in this fort was sub-divided into sections by doorways. Each section was accessed by its own passage and had its own lamp store. The two passages at Cliffe could be evidence of this arrangement as well as the doorway to the western section of the light passage; its well-formed three-course segmental head set neatly in the vault suggesting that it is an original feature. No corresponding features can be seen in the other branch of the lighting passage where the vaulting is replaced by a sandstone slab.

The absence of vaulting in the area immediately above and to the north of the junction, along with the inserted doorway in the entrance passage and the corner light box, suggests that this shifting passage has been modified or even inserted at a later date, although at a point in time when the 11-inch RMLs still formed the main armament of the fort: their replacements required fewer ammunition stores and

Figure 7: View looking south from a branch shifting passage into the intermediate dog-leg entrance passage. The area of white render and disturbed brickwork in the foreground on the left of the picture indicates the position of the removed wall. Beyond this is the crossing with the main lighting passage. The angled light box for the 90 degree turn in the dog-leg passage can be seen in the background. (DP 097426)

these were concentrated at the north end of the basement (see Chapter 9). The large sandstone slab lintel that has replaced the vaulting is set level with the top of the lighting passage vault. This utilitarian arrangement is not used in the other shifting passages which are properly vaulted.

Further evidence of rebuilding connected with the insertion or modification of the shifting passage [95] area is provided by No 8 Shell Store [96] and No 6 & 7 Cartridge Stores [93 and 94] which may have been created from the short store-lamp recess combination noted in the south-west corner of the basement and on the plan of Coalhouse (TNA: MPHH171/1). Patches of render and areas of disturbed brickwork in the south-east corner of the junction between the shifting and lighting passages are witness to the removal of the end (south) wall of what had been a branch shifting passage for No 8 Shell Store [96] creating the current shifting passage (see Fig 7). Examination of the interior of No 8 Shell Store suggests that the walls of the earlier store were taken down and new east, west and south walls built to increase the size of the store: the new walls course through to each other and the south wall has slivers of brick making up the wall where it meets the earlier vault. On the west side of the store, in the current branch light passage, a section of the west wall at its north end shows evidence of reinstatement after the vault of the original shell store was dismantled. That the store was shorter than its neighbours is shown by the position in the south-east corner of a blocked doorway with a segmental-head;

this doorway is also visible in the new shifting passage. The stores surrounding No 8 Shell Store [96] which retain this combination of access via the branch shifting passage and segmental doorway have the door at the lighting passage end. Only the surviving short stores [103 and 57] have it at the face wall end. These stores are shorter to allow for the lamp recess at their south and east ends.

Considering the modifications to the stores and passages, it is likely that the intention was to create an additional shifting passage. The doorway inserted in the dog-leg passage produces the required lobby for the transition between dirty and clean areas. The area was lit by the inserted magazine light in the corner and provided with skirting boards, retained by copper nails, and pegs for hanging clothes, their position now indicated by a row of narrow slots in the passage wall. At the junction of the new shifting and light passages the circulation was controlled by the insertion of doors replacing the walls removed in the remodelling exercise. A control barrier indicated by holes at either side of the shifting passage, immediately west of where it crosses the lighting passage, separated the two. In the lighting passage the remains of a wooden door frame with a quadrant-shaped head is visible between the entries to the shifting and lighting passages. A similar door frame is visible in the lighting passage to the east of the junction. The use of doors in this fashion was not noted in the other entrances.

North-East Entrance

The north-east entrance has, like the two previous entrances, a single open entrance passage from the fort, its east wall formed by the front wall of the ablutions and latrines in the east range and its west wall including a traverse formed by a flight of stairs to the top of the rampart. As with the other passages it then bifurcates, the smaller lighting passage being entered by an arched headed doorway in the riser wall of the stair and the shifting passage continuing straight on through a doorway in the substantial flank wall of the demi-bastion in this corner of the fort.

As with the others, the lighting passage to the west is a simple brick-built semicircular vaulted passage describing a dog-leg turn and then entering the main light passage beneath an arched head. Located in the east wall of this passage is the opening to the light box that lights the corner of the adjacent shifting passage. The shifting passage is considerably larger and more elaborate, with an impressive series of vaults as it turns through two 90 degree corners to join the main shifting passage running parallel to the face wall. The passage mirrors the arrangement in the south-west corner of the fort. As built, the shifting passage was entered beneath a double arched entrance, of which the second arch acts as a set back for outward opening doors. Immediately inside the doorway was a second pair of doors hung to open inwards, closing against the passage sides in recesses let into the vault. The frame for these doors followed the example in the intermediate passage, set into the crown of the vault, but in this case is original with the frame set in a carefully formed recess rather than being cut into the brickwork. The passage then turns through 90 degrees to head east, the corner being lit by a magazine light with sandstone sill and lintel. Beyond this, in the north wall of the passage is a doorway into what is labelled as the QF (Quick Fire) Ammunition Store [82] on the 1899 plan (TNA: WO78/4963;

App Fig 1). Examination of the doorway reveals it to be inserted beneath a substantial flat stone lintel, the recess for which has been cut across the springing of the vault leaving areas of damaged brickwork and rendered repairs. The passage then continues to the second 90 degree turn which takes it back towards the north performing a dog-leg to accommodate the rounded wall of the redundant stair shaft.

Opposite this shaft in the west wall are two blocked openings. The one to the south is beneath a quarter vault. Examination of the 1899 plan (TNA: WO78/4963; App Fig 1) shows that this is the blocked lighting passage and inspection of the other side of the blocked opening in what is now the QF (Quick Fire) Ammunition Store [82] which shows the same quarter vault, beneath which is a standard two-course segmental doorhead. The opening to the north has a flat stone lintel and this, along with the ragged brickwork around the bull-nosed jambs, suggests that the opening has been inserted. However its insertion would have been a major undertaking and the brickwork around the lintel is crisp with no cut bricks or render patches. To the north of this opening is further disturbed brickwork which can be related to a corresponding sandstone lintel inside the QF(Quick Fire) Ammunition Store [82]. This may be the position of an original entrance.

The shifting passage heads north past the first casemate which contains two small stores, the previously mentioned QF (Quick Fire) Ammunition Store [82] to the south and No 1 Shell Store [84] to the north with its attendant lighting passage. Both stores show evidence of considerable alteration. Beyond, to the north, the passage ends at a brick wall blocking what would have been the entrance to the main shifting passage. This blocking is keyed into the recess for a shell or cartridge lift in the face wall and incorporates two large air bricks of an elaborate late-19th or early-20th century design. This wall was constructed during the conversion of this section of the shifting passage into a Small Arms Ammunition Store, probably in the late 1880s (see Chapter 9).

On entering the QF (Quick Fire) Ammunition Store [82] it is clear that, as previously discussed, the southern doorway has been inserted beneath a substantial masonry lintel. Further evidence for this work, in the form of cut bricks and patches of render, is visible around the head of the door. It is clear that what was the rear (south) wall of casemate has been taken down and the main lighting passage incorporated into the store. The course of the former rear wall can be detected from scars on the store vault and a pronounced step where the north-south vault of the store meets the east-west vault of the former lighting passage. The blocked ends of this passage are visible in both the east and west walls of the store. Adjacent to the blocked light passage is the blocked doorway that led through the casemate's east wall into the shifting passage. To the north, set in the vault close to the east wall, is the sandstone lintel corresponding to the patch of disturbed brickwork noted in the former shifting passage [83]. Close examination of the brickwork in this area of the store reveals considerable variation and mismatched courses suggesting that the east wall and the south-east corner were not built at the same time as the west wall and the north-west corner.

Examination of the adjacent No 1 Shell Store [84] shows that this, too, has received

considerable alteration. The store is entered by a doorway in the south wall of the main shifting passage; its flat sandstone lintel and bull-nose jambs, along with patches of render and disturbed brickwork to the east of the doorway, show that it is inserted. Entering the store it is immediately apparent that there is a blocked doorway beneath a three course segmental head in the west wall. The blocking incorporates a magazine light with no apparent masonry sill or lintel suggesting that this is a later insertion in the blocking. Close examination shows that the north-west corner is also inserted as the brickwork does not course through with the rest of the store. Set in the vault is a wrought iron loop of the type associated with shell stores but a patch of inserted brickwork surrounding it suggesting that this, too, is a later addition.

The arrangement of the store can be explained by comparison with the shifting and lighting passages in the south-west corner of the fort. As built, the shifting passage was entered through the two sets of doors forming the dirty/clean transition into a changing lobby lit by a magazine light in the north-west corner. At the end of this passage in the north-east corner, opposite the stair shaft, were two adjacent openings. The most southerly opening was at the end of the light passage, the one to its north either beneath the current lintel or slightly to the north beneath a head now replaced with a masonry spreader, formed a doorway into a store occupying half the space of the present QF (Quick Fire) Ammunition Store [82]. The size of this store is shown by the scar for the rear wall on only the east side of the casemate vault. Immediately to the south of this rear (south) wall was the lighting passage extending from the current passage to an opening through to the shifting passage; its segmental head is still present in the blocking in the west wall of the current QF Ammunition Store [82]. Comparison with the layout of the shifting passages in the south-west corner of the fort suggests this opening may have accommodated a light box for the shifting passage and that the remaining space in the first casemate would have been occupied by a lamp store. This area is now occupied by the west wall of the enlarged QF Ammunition Store and the entrance to the branch light passage to the west. The construction of the walls for the north-west corner of the QF Ammunition Store have removed any evidence for its presence.

Further comparison with the south-west corner of the fort suggests that No 1 Shell Store [84] would have formed a small store connected to the main shifting passage by a branch shifting passage running north-south. The doorway from this passage is the blocked segmental headed opening in the west wall of the store. The remains of this branch shifting passage are now incorporated in the present branch light passage. This continues to the main light passage via a new section partly formed by the new walls to be found in the south-west corner of the QF Ammunition Store [82]. Its predecessor, based on comparison with the south-west corner passages, would have ended level with the front (north) wall of QF Ammunition Store [82] with the conjectured lamp store beyond.

Later Entrance Passage

Immediately to the west of these passages in the north-east corner of the fort is a Shifting Lobby [88]. This passage is a much later insertion which, along with the blocking and remodelling in the north-east passages, is associated with the mounting of quick-firing weapons at Cliffe in the late 1890s (see Chapter 9).

Shifting Passages

The three entrance passages lead into the main shifting passage which provided space for the transfer of cartridges and shells from their respective stores to the guns above (Fig 8). This vaulted, brick-built curving passage runs at the front of the stores and the ammunition reached the guns via lift shafts pierced through the vault. The shafts are arranged so that both the shells and cartridges emerge on the gun floor at the muzzle end of the guns. As noted previously (see Chapter 5) this is not ideal and is evidence of the compromises embodied in the redesign of Cliffe Fort. Survey of this area was hampered as the passages and stores were flooded to an average depth of 0.3m and full of debris. Some shell and cartridge shafts show evidence for bat activity.

Figure 8: The shifting passage looking north-east. At the base of the wall on the left side of the picture are the recesses for the ammunition lift winches. Located out of shot to the right are the end walls of the ammunition stores. A shaft for the ammunition lift rises from the recess at the top of the vault. The arched headed opening in the middle distance is the blocked entrance to the demolished caponier. (DP097444)

Shell and Cartridge Lifts

As previously related, £700 of the money that had been allowed in the 1869 financial estimate for internal alterations was spent on remodelling the stores to deal with the new ammunition arrangements, particularly new shell lifts and 'making good' (TNA: WO30/106/127). Detailed examination of the shaft for No 1 Cartridge Lift shows that part of this work was the piercing or major modification of the shafts through the vault. All the shafts rise through the centre of the arched head that carries the casemate wall over the shifting passage to a junction with the face wall. The base of the shaft was formed by removing a section of the arch soffit adjacent to the front wall of the passage and then inserting a sandstone lintel; evidence of this work being slivers and half bricks in the brickwork surrounding the lintel. The circular shaft through the vault is lined with regularly coursed but slightly uneven brickwork and this also shows a course of slivers and cut bricks where the brickwork of the shaft meets the floor of the gun battery. At the base of the shaft are regularly-spaced sockets extending around its circumference formed by omitting headers (Fig 9). These may relate to mounting for a timber stave guide, an intact example of which survives in the 9-inch RML magazine close to No 17 Shell Store [58] in the south-west corner of the fort. This example shows that the stave hoop is retained inside the shaft by an iron collar anchored into the slots formed by the omitted headers. There are two similar holes below the shaft, cut into the front wall of the passage, which may indicate the course of a guide or rubbing strake.

The ammunition shafts also accommodate the iron speaking tube connecting the battery to the ammunition stores. A pronounced mortar course or a roughly cut channel in the brickwork and masonry marks the path of the pipe as it runs down the shaft and then across the front wall of the passage. The relatively poor quality of this work compared to other alterations in the fort may suggest that the speaking tubes were a later insertion, though this seems unlikely as they were vital for the operation of the ammunition supply system. It may be that the poor quality work is evidence of a change in their course at some point.

The only documentary source detailing the arrangement of the shell and cartridge lifts is the 1899 plan of the basement (TNA: WO78/4963; App Fig 1). This shows the arrangement of lifts after 1889 when four 11-inch RMLs had been removed and their casemates converted into traverses. The labelling on the plan shows that each of the remaining seven guns in the casemated battery was allocated one shell lift and one cartridge lift, served by one cartridge store and one shell store. The plan shows that the majority of the shell lifts had an associated recess in the face wall, presumably for mounting the winch machinery to hoist the shells up to the gun floor, while the majority of the cartridge lifts are indicated at the mouth of the shaft set in the vault of the shifting passage. Presumably this is an indication of the lighter cartridges being hoisted by a simple man-operated pulley system (Moore 1996, 39). This arrangement might date back to the completion of the fort in 1877. However, cartridge lifts Nos 1 and 4 are provided with a recess while No 3 Shell Lift lacks one. This suggests some rearrangement in lift allocation after 1889 in order to give every remaining gun its own shell and cartridge lift. Survey showed that even this arrangement is no longer in evidence. All the shafts, other than No 13 Cartridge Lift adjacent to No 14 Shell Store [102] and the two beneath the southern 9-inch RML open battery position [57], are provided with recesses.

Figure 9: Detail of No 3 Shell Lift looking upwards towards the gun floor. The sockets for the collar anchors can be seen. (DP097451)

The survey noted some differentiation in the form of the recesses. Those for casemates 1 and 2 [unnumbered, No 1 Cartridge and No 2 Shell] have arched segmental heads. It is also noticeable that the 1899 plan (TNA: WO78/4963; App Fig 1) shows these three recesses as sequential with no interposed cartridge shaft. This is because two 12.5-inch RMLs were originally mounted in casemates 1 and 2. These weapons used double cartridges, which were hoisted in a special cage weighing 17lb (Moore 1996, 5, 39) which would have required assistance from a winch. Subsequently, Casemate 1 was converted into a traverse and its 12.5-inch RML moved to Casemate 4 (see Chapter 9). The redundant recess for the Casemate 1 lift was reused to key in an inserted wall blocking the north end of the shifting passage when the connecting passage in the north-east corner was converted into a Small Arms Store [83] (see Chapter 9). Casemate 2 remained in use as a 12.5-inch RML position and presumably its ammunition supply arrangements were not altered. This suggests that these three lift positions have remained largely unaltered since the construction of the fort and represent the original form of the shell lift recesses. All three recesses are set back into the foot of the face wall, approximately 1.0m high and centred beneath the opening for the shaft through the casemate vault.

The recesses have single, arched segmental-head of two courses of headers. No 1 Cartridge Lift and No 2 Shell Lift have a second smaller square recess cut out of their north side suggesting a later modification associated with the winch machinery.

The only other shell lift that has the same appearance as the 12.5-inch RML lifts is No 10 Shell Lift. This has an identical head to Nos 1 and 2 lifts and a single recess rather than the pair shown on the 1899 plan, where it is also mis-labelled as No 8 Shell Lift (TNA: WO78/4963; App Fig 1). The lower water level in this part of the passage reveals that the rear of this recess is rendered and a low brick plinth has been constructed in its centre, the brick colour suggests that this may be a later addition. The recesses associated with the other shell and cartridge lifts have flat sandstone sills, which is a common feature of later modifications at Cliffe, and taller (1.5m) recesses. As they are presumed to be later alterations these lifts will be discussed in Chapter 9. The existence of No 10 shell lift goes someway to suggesting that the original ammunition supply scheme for Cliffe was for winches, set in arched recesses, hoisting the shells from basement to gun floor with the lighter cartridges moved by a simple pulley system suspended in the shaft. Based on the arrangement shown on the 1899 plan, if the number of recesses shown reflects the original distribution of shell lifts; then the ammunition supply to the seven 11-inch RMLs originally mounted in casemates 3 to 14 would provide each pair of guns with a shell lift and a cartridge lift.

Of note is the mistake in the labelling of the shell lifts on the 1899 plan (TNA: WO78/4963; App Fig 1), not perhaps surprising if they were drawn to record the fort's drainage system. The mistake is simple, the label 'No 8 Shell Lift' is used twice: once for the lift opposite No 10 Shell Store and again opposite No 12 Shell Store. If we assume that the second label opposite No 12 Shell Store is evidence of an earlier numbering scheme then this gives rise to a scheme with number 1 lift beneath casemate 3 (the first of original 11-inch RML casemates) running to lift 12 beneath casemate 14, the final 11-inch RML. The three lifts beneath the 12.5-inch RML guns in casemates 1 and 2 presumably had their own numbering sequence to differentiate them from the lifts for the smaller calibre guns.

Caponiers

The loan return of 28 August 1869 allowed for the construction of three caponiers at £370 each (TNA: WO30/106/127). A caponier was a small casemate which projected beyond the fort and allowed flanking fire along its face. Survey showed that the entrances to these caponiers are visible in the face wall. The entrance to the caponier north of No 6 Cartridge Store [93] consists of an arch-headed recess which has been neatly blocked with bricks and then rendered over (Fig 8). The second entrance is visible just to the south of No 12 Shell Lift, bricked-up flush with the main wall of the passage. The 1899 plan (TNA: WO78/4963; App Fig 1) suggests that the third entrance should be in the casemates rebuilt to house the Brennan torpedo installation. The south casemate of these has a two-course relieving arch to the south of the current passage through the face wall which may mark the position of the former caponier. On the opposite (glacis) side of this wall is the flat-roofed Brennan torpedo storage room, constructed in the ditch. In its south-east corner is

a brick-built segmental headed recess let into the exposed face wall of the fort. This may also mark the position of the demolished caponier.

The 1899 plan (TNA: WO78/4963; App Fig 1) provides further detail for the now blocked caponiers, showing that the two remaining entrances opened into tight dog-leg passages passing through the face wall. A similar arrangement can be seen in an excavated example at Coalhouse Fort. On the 1899 plan of Cliffe the blocking of the west end of the passages with further rubble stone can be discerned. It is not clear what form the caponiers would have taken. The 1887 plan of Shornemead (TNA: WO78/2601/11) shows the tops of the caponiers at this fort. In form they appear very similar to the example at Landguard Fort, Felixstowe, which has a narrow central passage serving a rank of three loopholes on each flank. In section it has thick walls and a pitched brick vault covered by a substantial layer of earth and stone bombproofing (Pattison 2006, 14). Unlike the Landguard example, the Shornemead caponiers ended at a conventional face wall and sat within a semi-circular cut out in the counterscarp of the ditch.

Shell and Cartridge Stores

The basement was constructed with one store, for either cartridge or shell, occupying three quarters of each casemate. Examination of the vaulting in the Brennan torpedo area, where the store walls have been demolished to leave just the casemate, shows that the stores form a secondary vault beneath the casemates, the space between being filled with brickwork and mortar. Originally the rest of the casemate was occupied by an accompanying branch shifting passage opening off the main shifting passage. Both this passage and the accompanying store were lit by magazine lights set in their rear walls. Access from the branch shifting passage into the store was by a segmental headed doorway in its side wall. Four stores: No 4 Cartridge Store [91], No 9 Cartridge Store [97], No 11 Cartridge Store [99] and No 13 Cartridge Store [101] retain this arrangement, including the magazine light in the end wall of the passage.

Cartridge Store Description

The following generic description is based on No 11 Cartridge Store [99] which was in the best condition and the most accessible at the time of survey. The store is near rectangular in plan with a shallow brick-built segmental-arched vault sprung from the north and south walls at a height of approximately 2m. Both the English-bond walls of the store and the vault are whitewashed. The thickness of the coating suggest that this was repeated many times and that the instruction to whitewash the walls against damp, included in the 1867 report to the Defence Committee (Jervois 1867, App 3) was obeyed. Due to flooding the bottom 0.3m of the store and the solid floor were not visible. No skirting or lining was visible and no dwarf walls or the ends of joists were detected with probes or feet. This suggests that the floors of the stores were finished with concrete over gravel as ordered in the 1869 letter (TNA: WO30/108/122) and depicted on the section in the 1899 plans (TNA: WO78/4963).

The entrance to the store is in the north-east corner beneath a segmental arched doorhead composed of two courses of headers. The jambs of the doorway are

closed on both sides and step out by one brick thickness to form a rebate to accept a doorframe. Each jamb incorporates two timber noggins inserted in header courses at its head and foot for mounting the substantial frame; copper nails used to secure the frame are visible in this position in No 15 Cartridge Store [103]. The position of the rebate and the frame along with study of the section through the corresponding stores at Shornemead dated March 1877 (TNA: WO78/4369), show that a pair of doors opened into the store closing flush with the frame.

The study of contemporary fortifications and correspondence with Victor Smith and Roger JC Thomas suggests that the cartridge stores should be lined with timber boarding and then equipped with timber racking to accept cartridges. Correspondence dated 17 June 1873 (TNA: WO30/108/210) concerning the magazine fitments at the Lower Thames forts may refer to this when it notes that the walls of the basements of these forts are so damp that 'it would not be advisable to fix the wooden fitments, studding and battening of the magazines and shell rooms'.

Study of the 1877 plan of Shornemead (TNA: WO78/4369) shows timber boarding, posts and rails, labelled as skidding, stretching from the floor to the vault. The presence of skidding, boarding or even battening cannot be established with any certainty at Cliffe. However, there are some fragmentary signs: in the west wall of No 13 Cartridge Store [101] a column of four brick-sized wooden blocks starts at about 0.9m above the floor (or water level) and runs to just below the springing; visible in the western wall of No 4 Cartridge Store [91] are two rows of horizontal slots spaced eight courses apart and stretching the entire length of wall; similar holes at the same height are visible in both north and south walls of No 15 Cartridge Store [103]. It is possible that installation commenced but was not completed.

Contemporary accounts place emphasis on the importance of ventilation in all ammunition storage areas and most stores were provided with air vents (House of Commons 1869, Appx 3). In No 13 Cartridge Store [101] a drop in water level revealed two vents, formed by rectangular openings approximately 0.30 m high, incorporated in the brickwork and closed at both sides, at the foot of the rear wall flanking the light box position and opening into the lighting passage. Probing revealed the presence of these vents in other stores. In No 13 Cartridge Store [101] a partially rendered over rectangular opening with a timber frame is set in the north side of the vault close to the doorway. This appears to be another air vent and a rendered patch in the opposing side of the vault may indicate the presence of a counterpart. Careful examination of this area in the other stores revealed disturbed brickwork in these areas.

Shell Store Description

The shell stores are nearly identical to the cartridge stores (Fig 10), although no shell store has survived with the original configuration of doorway and branch shifting passage. The main difference between the two types of store is the setting of a large wrought iron loop in the crown of the vault. In the majority of the stores that are labelled as shell stores on the 1899 plan (TNA: WO78/4963; App Fig 1), the loop is set neatly in the vault with no indications that is not original. However, in several

other stores, notably No 12 Shell Store [100], it appears that the iron loop has been inserted into a rectangular rendered patch to the north of the crown of the vault suggesting that these stores may have been converted from cartridge stores. As the iron loops are only found in stores labelled as shell stores they must be related to the movement of the shells.

Figure 10: Interior of No 5 Spare Shell Store [92] which retains the plan and appearance of the ammunition stores as built. Note the light box in the rear wall and the sturdy timber door-frame with pegged joints and retained by noggins set in the brickwork. (DP097445)

Three groups of stores: No 3 Shell Store [89], No 4 Cartridge Store [91] and No 5 Spare Shell Store [92]; then No 12 Shell Store [100], No 13 Cartridge Store [101] and No 14 Shell Store [102]; and finally, No 16 Shell Store [104] and No 19 Cartridge Store [103] have openings set below vaulted heads in the wall opposite to their original segmental-arched doorways. All of these blocked openings are through the width of the casemate wall, hence the low height, the vaulting and frequent use of masonry lintels to spread the load of the casemated battery above. The intended function of these openings is unclear. As they rise in the casemate walls, like the shafts for the shell and cartridge lifts in the shifting passage, they may have been intended for shell lifts that emerged as per the recommended designs at the rear of the gun positions.

Lighting Passage Description

This passage provided a route, separated from the stores and shifting passages, for the maintenance and placing of lights for these areas (Fig 11). To guard against the

possibility of an explosion all the lights in the stores and shifting passages were placed behind a sealed glass pane set in a brass frame. The light was placed behind this frame in a specially constructed recess in the passage or store wall, accessible from the lighting passage (Fig 12). Located at the head of the access passage from the outside of the fort, or in convenient recesses in the passage, were lamp stores intended for the filling and trimming of the magazine lights. As previously discussed these lamp stores, other than examples at the south-west corner and adjacent to No 19 Cartridge Store [103], have disappeared, incorporated into other stores or passages during alterations to the basement.

Most of the light passage is undisturbed by later work and remains an annular passage running parallel to the main shifting passage, with a brick-built irregular quarter vault springing from the rampart retaining wall and leaving just enough space to stand upright. All the walls of the passage have been whitewashed, although not with the same vigour as the walls of the stores. The upper walls of the passage are noticeably dry, possibly a consequence of the air current in the passage. This could be an intentional feature to assist with the burning and venting of the lights. The plan of Fort Gilkicker, Gosport (www.fortgilkicker.co.uk accessed 25.01.2011) shows that its lighting passage was provided with air vents set in the outside wall opposite the light boxes. There is no evidence for this arrangement at Cliffe, perhaps due to the natural air current; a small number of ventilation shafts are spaced at irregular intervals with each shaft terminating in a rectangular opening set at the top of the vault. The best preserved of these, with a metal lining, is visible in the vault to the south of No 7 Cartridge Store [94]. Another, a rubble-filled rendered rectangular opening, with the remains of a timber frame and an iron shutter visible inside, is located just beyond the branch passage south of No 10 Shell

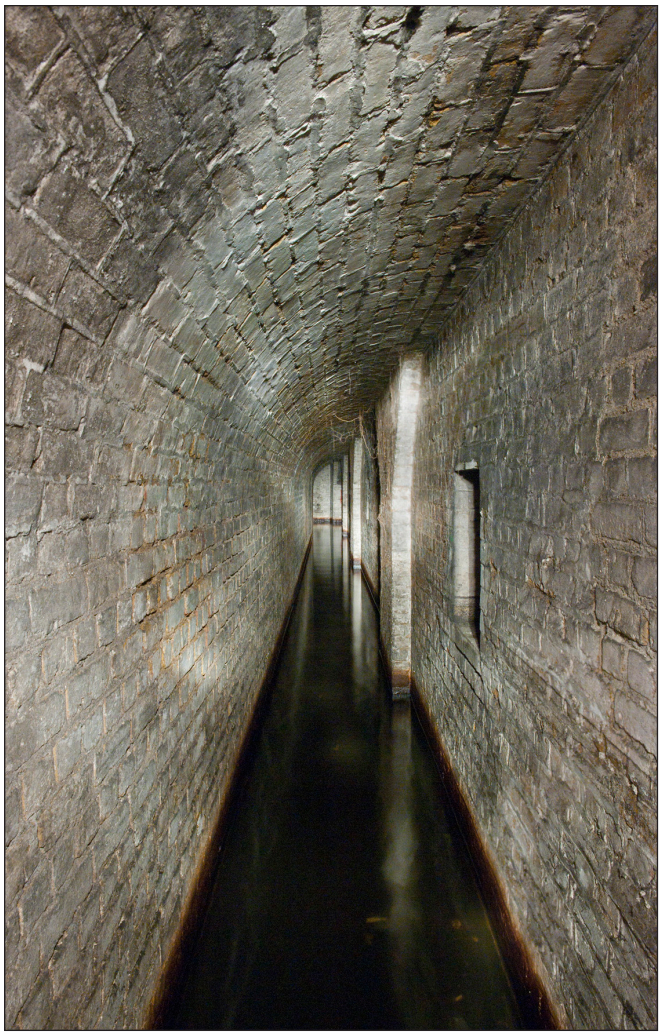

Figure 11: The main lighting passage looking south-west showing the restricted height of the passage and its slightly irregular vault. An opening for the light box in the end wall of the ammunition store can be seen in the wall on the right of the photograph. (DP097416)

Store [98]. Both these shafts are cut through the vault. The use of render and the absence of a sandstone lintel, as in the ammunition shafts, suggests that they are later insertions. Study of the 1899 plan (TNA: WO78/4963; App Fig 1) suggests that the shafts emerged at Howarth vents which are shown at irregular intervals on top of the rampart, following the course of the lighting passage.

Figure 12: Close up view of a light box from the lighting passage side. The vent pipe positioned just above the masonry lintel provided the oxygen source for the lamp flame. (DP097416)

The north wall of the lighting passage is formed by the end walls of the passages and stores in the casemates. Square openings for the magazine lights are pierced through these walls, set at an average height of 1.3m. The light boxes have a tooled sandstone sill and lintel, each rebated along with the brick jambs to allow the flush fitting of a brass-framed glass pane on the store or shifting passage side. In the soffit of the lintel is a funnel-shaped vent and this is connected to a vent tube that emerges in the wall of the light passage above the light box (Fig 12). The clearest example of this can be seen above lamp recess No 14. No entirely unaltered light box was found during the survey: most have sills patched with cement for later lighting installations. This work may have obscured any evidence for the brass anti-topple stop set in the sill or the runners for a zinc tray mounting the light mentioned in the *Handbook of Military Terms* (Moore 1996, 23). None of the boxes retain any part of the frame or glass panes or evidence for their removal. This suggests that the brass framed lights detailed in the 1869 correspondence (TNA: WO30/108/172) were installed rather than the earlier panes, as described at Grain (Wilson 1963, 150), of polished sheet glass bedded in white lead, the removal of which is likely to have left traces behind. Each recess was numbered with an oval number plate attached to the wall with copper nails, usually on the right hand side of the recess. The witness marks for the removal of these plates can be clearly seen at lamp recesses No 6, for No 3 Shell Store [89] and No 21 lighting the passage north of No 11 Cartridge Store [99], amongst others. The rearrangement of the passages and lighting scheme may have resulted in the renumbering of the recesses; the removal of the plate from lamp recess 24 has revealed the number '27' written beneath.

Early Modifications

There is no documentary trail for the modifications to the stores and passages but a clear sequence presents itself. The first modification must have been to the lighting arrangements. As completed the stores and the ends of the branch shifting passages would have been lit by magazine lights. There appears to be no means of lighting the shifting passage, not even natural light from the lift shafts which were boxed in at gun floor level. This deficiency must have made itself quickly apparent during early inspections. As the same modification to the lighting arrangements was also made at Shornemead and Coalhouse forts it suggests that this was recognised as a fundamental failing rather than just a local difficulty.

The creation of additional lighting passages for the shifting passage must have been an early modification when all the gun positions were still in use. Great effort has been taken to keep all the stores; if this modification had been made in the late 1880s, when four 11-inch RMLs were removed for the creation of traverses, then some stores could have been sacrificed to the new lighting arrangement. The insertion of the additional lighting passages is a modification of admirable simplicity. The majority of the branch shifting passages that run down the side of each store have been modified by blocking up their west or north ends and opening up the east or south ends to become branch lighting passages. These new passages served a magazine light set at the springing of the vault of the shifting passage via a 90 degree turn and a set of steps inserted at the west or north end of each passage.

The evidence for this work can be seen in the main lighting passage and within the stores. In the lighting passage new entrances were made beneath the casemate vault into the branch shifting passages by dismantling the end walls of the passages. This work has left a distinctive band of render and uneven brickwork at nearly every branch light passage entrance, particularly at the openings in the section of lighting passage between No 11 Cartridge Store [99] and No 14 Shell Store [102]. A more extensive modification can be found at the entrance to the branch passage running to the south of No 10 Shell Store [98] where the vault has been cut back and a sandstone lintel has been inserted to provide support.

At the west or north end of each passage the blocking of the entrance from the shifting passage to the branch shifting passage was necessary to prevent the creation of numerous through routes between the lighting and shifting passages. The entire front wall of each adjacent store was rebuilt, both to accommodate the new magazine light and to create a new entrance to replace the one that would be blocked by the modification of the branch shifting passage. Evidence for these blocked entrances has already been discussed. It has left an obvious patch of brickwork beneath a segmental head in the corners of the stores. Corresponding brickwork patches and the head can be seen in the walls of the former shifting passages.

The new front wall has its entrance beneath a sandstone slab lintel (Fig 13). In many stores this work is neatly executed, suggesting that the entire wall was demolished and rebuilt, but several stores have areas of disturbed brickwork, cut bricks and slivers showing where the lintel has been inserted. A variety of door frames can be found beneath these lintels and only the one in No 2 Cartridge Store [86], which has

Figure 13: Interior of No 4 Cartridge Store [91] rebuilt for the insertion of a branch lighting passage. The end wall of this passage is to the right of the inserted doorway into the shifting passage. The wall brackets supported the fuse and primer box. (DP097453)

pegged mortice joints and a bead moulding, appears original. This frame suggests that the doors to the store would have opened inwards.

The new magazine lights are set behind the new front walls in simple recesses, their heads formed by the vault and their base a shaped stone sill (Fig 14). One example of the light survives in Cliffe Fort in the south-west corner, over lamp recess 33 adjacent to No 17 Shell Store [58]. Other examples can be seen at Coalhouse, some of which were removed from Cliffe (V Smith pers com). On the shifting passage side the recess is covered by a semi-circular metal cover. A ferrous rim to this cover, and the semi-circular profile formed in the face of the sill, suggests that a glass light globe fitted below the cover, sitting in the recess in the sill. From the lighting passage side the light was placed in the cover through a simple recess in the wall. This recess was reached by a set of steps placed in the 90 degree turn at the end of the branch passage. The passage wall to this turn is also a new section of brickwork and projects into the body of the store forming a distinctive corner immediately adjacent to the new entrances (Fig 13). That these passages are later work and made use of recovered material is illustrated by the branch passage between No 13 Cartridge Store [101] and No 14 Shell Store [102] where the top step up to the lamp recess is formed from the sandstone lintel of an earlier lamp recess complete with funnel-shaped depression. As all the steps in these recesses are sandstone it is possible that the sills and lintels of all light boxes that lit the ends of the demolished branch shifting passages were reused in this way.

In the shell stores the new corner section created by the modifications has been used to mount or remount the fuze and tube shelf. The presence of these 1ft^2 timber boxes, open at the front and divided into four compartments for the storage of time and percussion fuzes for the shells (Moore 1996, 17), is indicated by a witness mark on the wall and pierced iron brackets set below it.

Later modifications to the basement, which include the rebuilding of stores [93, 94, 96 and 103] and the insertion of the entrance passage [88] immediately to the west of the shifting and lighting passages in the north-east corner, will be discussed in Chapters 9 and 10.

Figure 14: Inserted opening for No 16 light box at the springing of the shifting passage vault. The witness marks shows the position of the cover. The glass pane was set in the foot of the opening below the sandstone sill. (DP097437)

Inner Rampart Wall and Traverse

The inner rampart is an earth bank forming the bombproof layer over the rear of the basement. The earth is sloped above the quarter vault of the lighting passage and retained along the edges of the parade ground by a low brick wall. The 1899 plans (TNA: WO78/4963) show that to prevent the spread of damp, the walls in contact with the earth rampart were tanked with Portland cement. The same plans show the top of the slope levelled to form a walkway which is coloured to suggest a combination of asphalt and paving. This area is now heavily overgrown and evidence for these materials was not found. The walkway connected all the living casemates and the open battery and was linked to the parade ground by four stairs, one at each end of the battery where they form the traverses to the basement entrances, another one performing the same function for the intermediate entrance and a flight outside

Casemate 14. All have the same construction: granite steps set between brick-built riser walls with brick copings and sockets for handrails. In the south-west corner one example of a cast-iron handrail stanchion, ribbed and with holes for a handrail in the centre and at its top, survives.

A number of buildings are set into the inner rampart. The larger buildings, the Test Room and Engine Room [70] [71] in the north-east corner and the Accumulator Room [66] and the Laboratory [61] and its passages in the south-west corner, use the rampart wall as their rear wall. The smaller buildings, the QF Gun Shed [67] and a number of stores, are built into the rampart but have a substantial concrete retaining wall between them and the brick-built rampart wall (TNA: WO78/4963; App Fig 1). The construction of these various ancillary buildings in the rampart is not something found at Shornemead or Coalhouse probably because their larger size provided more room in the existing structure for these activities.

Laboratory/Shell Filling Room [61, 62, 63, 64]

As previously discussed, after 1867 revised ammunition arrangements required that cartridges and barrels would no longer be filled at the battery but would be delivered from Woolwich made up and sealed in zinc containers (Moore 1996, 62). Consequently only one specialised shell-filling room or laboratory for examining suspect cartridges and fuses would be required at each battery. However, the increased complexity and volatility of the new cartridges required more stringent safety precautions with the filling room provided with work benches, handling hatches and a separate light passage. The construction of such a building at Cliffe is reflected in the letter dated 10 February 1872, from the Chief Royal Engineer, Gravesend, to the Inspector General of Fortifications, discussing the enlargement of the shell filling room at Cliffe and the ordering of additional wrought iron joists for the enlarged roof (TNA: WO30/108/101).

The 1899 plan (TNA: WO78/4963; App Fig 1) labels the large rectangular-plan building in the south-west corner of the fort, immediately to the east of the open battery, as a Laboratory with a passage on its north side. Examination of this building shows that its details that match those in the domestic ranges: English bond brickwork in the same stock brick and the Fox and Barratt patent fireproof roof of wrought iron beam and concrete fill, subject of the 1872 correspondence (TNA: WO30/108/101). It is notable that this ceiling is set very high, nearly 2.5m (9 or 10ft) from floor level (Fig 15).

Structural and documentary evidence suggests that this building was constructed as a danger building for the handling of explosives. Depictions on the 1891 drainage plan (TNA: WO78/3427) show the building isolated in the south-west corner, the stores and sheds shown surrounding it on the 1899 plan (TNA: WO78/4963; App Fig 1) being later additions. Both these plans show it surrounded with traverses: at its rear the substantial brick and concrete traverse of the open battery, which continues down into the basement and forms the rear wall of the Laboratory and its attendant passages, and to the north and south the earth rampart. The rampart is retained by the 6ft (2.0m) thick wall south of the laboratory and the north wall of the adjacent passage. All of this work was presumably to protect the rest of the fort if the Laboratory exploded. The same arrangement can be seen at Shornemead on its record plan (TNA: WO78/2601/11).

Figure 15: The former Laboratory [61], later converted to the entrance and stores for the Brennan installation. Above and behind is the traverse at the rear of the open battery. Casemate 15 is to the right with the back of the Brennan observation post above it. (DP097566)

The 1899 plan (TNA: WO78/4963; App Fig 1) shows that the building was divided into three rooms [61,63 & 64] and a passage [62] to the north. It comprised the large rectangular room labelled as 'Laboratory' and an L-shaped room to the south with a large lobby to the east. As the front wall of the building has been demolished, and what is presumably the resulting rubble used to fill the interiors to ceiling height, further description is based on the 1899 plan. This plan shows that the front (east) wall of the Laboratory [61] had a doorway with a porch and, to its south, a centrally-placed window, with a sash, and what appears to be a hatch set flush with the outside wall to the south of the window. Inside the Laboratory, in the south-west corner, was another entrance opening into the L-shaped room [63] where its blocked doorway can be seen. The 1899 plan shows that the Laboratory was provided with work benches at its west and east sides but confirmation of their survival was not possible due to demolition rubble.

The passage [62] to the north of the Laboratory [61] now forms the entrance to the Brennan torpedo installation (see Chapter 10). It was substantially rebuilt for this purpose and only its south wall, which it shares with the Laboratory, is original. Its rear wall, which was against the rear of the traverse of the open battery, has been demolished to create the entrance into the Brennan torpedo casemates. The presence in the south wall of a light box, now blocked, and another at the end of a short branch passage at its west end, suggests that it was, originally, a much narrower lighting passage for the Laboratory.

To the south, the L-shaped room [63] is entered through a substantial lobby [64] at its eastern end. The wide entrance shown on the 1899 plan (TNA: WO78/4963; App

Fig 1) has been reduced in size with irregular English Bond brickwork. On its south side are the remains of the front wall, a stub of wall and a door jamb. The doorway between the lobby and the main part of the room is beneath a sandstone lintel and has a set back for an inward opening door with the frame position indicated by missing headers for timber noggins. This probably formed a clean/dirty transition area. The room ends in another lobby in the northern end of the 'L' containing an entrance - a deeply recessed and now blocked doorway with a flat sandstone lintel - into the south-west corner of the Laboratory [61]. This area was illuminated by a now-blocked magazine light, served from the branch passage at the end of the passage [62], set in the centre of the end wall.

The *Handbook of Military Terms* (Moore 1996, 22) contains a generic description of the function of the various rooms in a laboratory. All laboratories were under magazine conditions, lit by segregated magazine lights, and divided into a main chamber with two rooms along with an entrance, shifting lobby and barrier serving them. In the rooms either shells or cartridges were dealt with, never both at the same time. One room (the outer room) was for receiving and examining a shell or cartridge whilst the other (the inner room) was for filling a shell or examining a cartridge before marking and sealing it. A receiving hatch in the inner room allowed the cartridges and shells to be passed in from the outer room while the shifting lobby allowed cordite or powder for filling to be received. Once the examination was complete the sealed shells or cartridges could be passed back through the hatch into the outer room and issued via the hatch in the outside wall.

Disregarding later alterations it is possible to relate the current plan to the generic description. It would appear that the Laboratory [61] is the outer room as it had a hatch in the front wall and an entrance, which could contain a hatch, in its south-west corner opening into the L-shaped room [63], making this the inner room which received shells and cartridges for examination through the hatch. To the east was the shifting lobby [64] for this inner room. Once the shell or cartridge was inspected and sealed it was passed back into the Laboratory [61] and issued through the hatch in its front wall. The substantial porch provided for the entrance into the Laboratory presumably provided the clean/dirty transition point for the ammunition technicians. The magazine lights in the north wall and south-west corner of the Laboratory were served by the passage [62] to its north.

Test Room [72] and Engine House and Dynamo [70, 71]

These buildings occupy the section of rampart between the north-east corner, adjacent to the basement entrance, and the south traverse wall of the intermediate entrance to the basement. They are labelled on the 1899 plan (TNA: WO78/4963; App Fig 1) as Test Room, Engine House and Dynamo respectively, and these terms are specific, at this date and in this context, to structures associated with moored submarine minefields (Baker-Brown 1910, 14; see Chapter 11). The construction of the buildings, particularly the use of the rampart wall as the rear wall and their presence in outline on the 1891 skeleton drainage plan (TNA: WO78/3427) suggests that they are either original buildings or very early additions to the fort. The Submarine Mining Establishment at Shornemead, which maintained the moored

minefields in the Thames, was commissioned in 1879 (TNA: T1/16171) and it may be that these buildings, in particular the Test Room, are of a similar date and part of the wider infrastructure of the submarine minefield. These building are discussed in greater detail in Chapter 11.

Water Tanks [Unnumbered]

Two rectangular-plan underground water tanks, with attached manhole and filter chambers at their west ends are shown located beneath the parade ground to the south of the Test Room [72] and to the west of the Guard Room [75] on the 1899 plan (TNA: WO78/4963; App Fig 1). The plan shows them as entirely underground while the 1891 plan (TNA: WO78/3427) depicts them with substantial brick walls, in the same manner as surface buildings although it does label them as 'underground tank'. Study of both plans shows that rainwater from the roof of the casemates was channelled into the tanks via pipes connected to the filter chambers. There are no outward pipes, other than the later addition to the 1899 plan of a 3in suction main for the Brennan Torpedo steam engine, which bypasses the filter chamber, suggesting that these tanks were intended as a static emergency supply. The tanks were not located during the survey due to flooding.

Gyn and Tackle Store [73] and Lamp Room [74]

The Gyn and Tackle Store labelled on the 1899 plan (TNA: WO78/4963; App Fig 1) has been demolished leaving only the concrete base just below the current water level. The plan shows that it was rectangular, brick built and had a wide entrance in the west wall. A Gyn was a tripod used to assist with the lifting or mounting of ordnance; Tackle consisted of various sizes of pulley block and 18 fathoms of 4 and 5in rope (Moore 1996, 19).

Built against the east wall of the Gyn Store [73] was a small brick-built structure labelled on the 1899 plan (TNA: WO78/4963; App Fig 1) as 'Lamp Room'. This may be a later addition connected with the reduction in the number of lamp rooms inside the basement caused by its remodelling. The north wall of the Lamp Room [74] is set back to allow for the head of the well, presumably the one frequently discussed in correspondence from 1869 to 1872 (TNA: WO30/106/107).

Accumulator Room [69]

The Accumulator Room [69] is brick built, rectangular in plan and has a Fox and Barratt-type roof reinforced with external layers of poured concrete. All the walls are 9in thick, the usual measurement for domestic walls, suggesting that this building was intended as a simple store rather than for any specialised function. 'Accumulator Room' appears to be a new label for an older building. The building appears on the 1897 (surveyed 1895) Ordnance Survey map and the 1899 plan (TNA: WO78/4963; App Fig 1) as extending back to the rampart wall. The front (east) wall has openings for a door and a window, both under rubbed red-brick flat heads similar to those in the gorge ranges. The window opening has evidence both for a later casement frame and for a, presumably earlier, sash frame associated with a sandstone sill. This now

much patched sill has a socket for an external window bar, an added security feature further suggesting that the building was intended as a store. The interior is entirely clad in glazed white brick. This is a later addition (see Chapter 11) found in rooms where acid was handled and was associated with buildings used for the storage of accumulators, a type of acid-filled wet electric battery.

7. THE FORT AROUND 1870: THE BATTERY

The battery of Cliffe Fort is a two-storey colonnade of brick-built arched casemates running around the north and west sides of the fort and describing a gradual curve as it follows the shoreline. The casemates spring from masonry and rubble walling, while those in the basement storey spring from brick-built piers. The battery casemates have a gun position at the front with living quarters to the rear. Due to its use as a magazine the front wall of the basement incorporates a substantial thickness of masonry acting as a shell proof layer and supporting the base of the gun positions above. The structure sits on the 14ft deep concrete foundation raft poured in 1861 (TNA: WO30/108/154; see Chapter 5). Both the basement and the first floor of the colonnade are bombproofed. Study of the now partially demolished Shornemead Fort and the sections included with the 1899 record plan of Cliffe Fort (TNA: WO78/4963) indicate that this takes the form of several feet of loose aggregate concrete poured over the brick vaulting (Fig 16).

Figure 16: Detail view of the partly demolished casemated battery at Shornemead Fort. This shows the method of construction and the concrete fill used to bombproof the casemates. The earthernware ventilator pipe buried in the bombproofing and the masonry mounting for the ammunition hoist are visible. The reinforcing rods and concrete sections on the roof relate to a demolished Second World War structure. (DP097526)

External Description

The west wall of the colonnade forms the face (front) wall of the fort and is pierced by 13 embrasures for the fort's original armament of Rifled Muzzle Loaders: nine 11-

inch in casemates, two 12.5-inch in casemates and two 9-inch in open battery. The section included with the 1899 plan (TNA: WO78/4963) shows that the face wall comprises a sandstone rubble wall at basement level, supporting a poured concrete wall at first floor level faced internally with sandstone and externally with granite. Examination of the face wall shows that these substantial granite blocks have well set joints showing little mortar. The casemate embrasures are also granite in the form of semicircular arches of two orders set within a flat headed archway. The edges of both orders in the arch are rounded as an anti-ricochet measure. Set within the inner order of each arch is an iron shield with a central rectangular embrasure for the gun muzzle. Between the archways the granite walling courses through forming a continuous sheer wall about 14ft high extending to a stepped-out cordon. Investigation through the vegetation growth, and comparison with Coalhouse and Shornemead forts, suggests that rectangular cast-iron grilles flank each embrasure at a level slightly above the springing of the arch. There is fragmentary evidence that the face wall was painted black, possibly as camouflage. The foot of the wall is buried up to 6ft deep in the banked earth of the gently sloping glacis.

The open batteries have deeply-splayed openings in the granite wall. These are now mostly obscured by later modifications but the course of the splay and the depth of the embrasure can still be discerned when standing on the present roof. Surviving examples at Shornemead, Coalhouse and Tilbury forts show that, when new, the exterior face of these positions had granite-faced splays with a brick-built embrasure.

The First-Floor Gun Positions

Internal Construction

The internal face wall for the gun battery is built from sandstone ashlar blocks. These retain a concrete core filling the space between them and the granite outer face wall. The interior face of each embrasure is located beneath a deep, single-order arch springing from splayed walls that open out onto the gun floor. The splays are formed from carefully worked sandstone blocks. A granite slab forms the sill of the external arch and the floor of each embrasure.

The spacing of the embrasures, and hence the distance between the gun positions, differs between the eastern (casemates 1-8) and western (casemates 9-15) ends of the battery (Fig 17). This difference reflects the gradual curve in the face wall as it follows the course of the river. However, it should be noted that the wider spaced casemates coincide with the planned position of the Moncrieff gun pits. The difference in dimensions may reflect the delay in construction caused by the debate over the mounting of Moncrieff carriages at the south end of the fort (TNA: WO 30108/81; see Chapter 5).

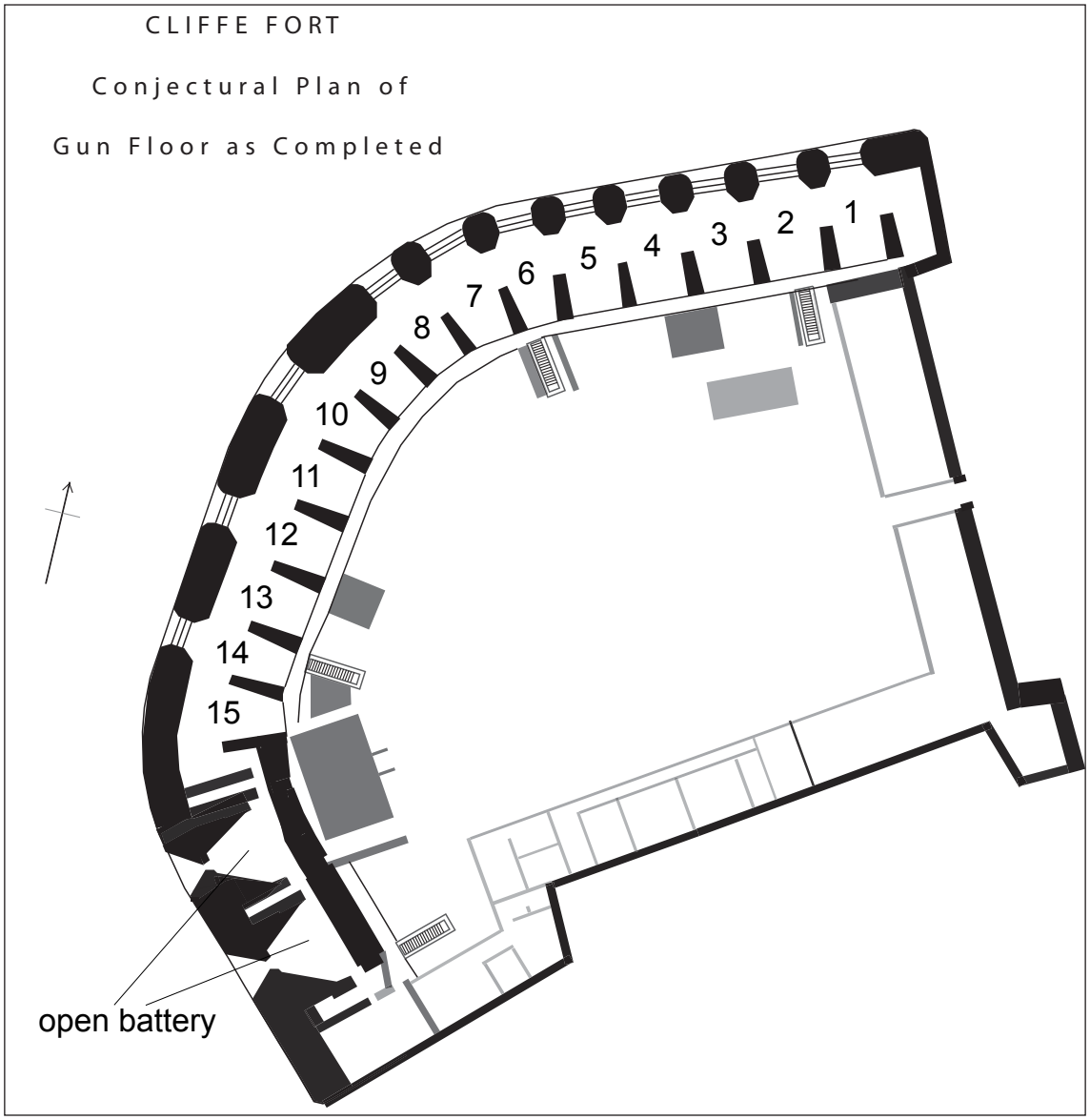

Figure 17: Conjectural plan of the battery as completed in 1875, based on the 1899 plan (TNA: WO78/4963) and investigation of the basement. The casemates are numbered as shown on the 1899 plan.

Casemates 1 to 8

Casemates 1 to 8 are to the north-eastern end of the fort with a field of fire that covers the Thames downstream as far as Hope Point and the Mucking Light. These are closely spaced casemates intended for seven 11-inch RMLs and two 12.5-inch RMLs. As built, the close spacing of the guns in this section required the ends of the slides of each gun position to interlace with its neighbours. This can still be seen in casemates 7 and 8 where the ends of the witness marks for the racers from casemate 7 can be seen projecting into Casemate 8. Each position has a brick-built bombproof vault, springing from the sandstone interior of the face wall and ending at substantial sandstone pillars forming a colonnade marking the rear of the gun positions (Fig 19). The bombproof vaulting is cruciform in shape, cut and shaped stock brick laid in stretcher bond forming an intersecting or cross vault. The internal face of each iron

shield is surmounted by a substantial sandstone single-order arch springing from the flanking sandstone walls (Fig 18). Possible traces of whitewash can be seen on the vaults. To provide ventilation to dispel the powder smoke after the gun had been fired, four ceramic vent pipes (approximately 1ft (30cm) in diameter) are set in a line along the apex of the east-west vault. Study of the part-demolished Shornemead Fort shows that the ceramic pipes from these vents describe a 90 degree curve and then run in the thickness of the bombproofing, emerging in the granite face wall at the iron grilles flanking each embrasure.

Each gun position was supplied with ammunition from the magazines and cartridge stores in the basement (see Chapter 6). This reached the gun floor via brick-lined shafts cut through the basement vault, bombproof layer and gun floor emerging next to the face wall. Each gun position was flanked by shafts, all of which survive, although many have been capped or filled with concrete (Fig 18). Moore (1996, 24) suggests that each gun position had its own shell shaft and shared a cartridge shaft. Above each shaft, set in to the brick vault just above the springing line, are substantial masonry blocks acting as the anchor for a pulley set used in the winch system to raise shells and cartridges to each gun position. Set into each block is a wrought-iron mounting bar in the shape of an inverted 'T' acting as a hanger for the pulley. Marks on the vault and unrendered areas of the later concrete traverses show that timber boarding was erected around each hoist position and sockets at the bottom of the masonry mounting block probably housed sections of the timber frame supporting the boarding. Immediately to the east side of the hoist positions not abutted by the later concrete traverses are speaking tubes connecting the gun crew to the magazines. The tube uses a 1in diameter iron pipe emerging out of the wall into a shallow-dished aperture. This section of pipe held a brass ferrule, inserted in which was a zinc whistle to draw attention to a call from the magazine (Moore 1996, 39). No whistles or brass ferrules survive but the ends of speaking tubes are visible in Casemates 6 to 14.

The floors are a combination of fine-grained screeded cement and compacted earth or chalk, though given the considerable amounts of concrete added during the 1880 remodelling it is difficult to state with certainty the original form of the floors. Casemate 4 has an unconsolidated compacted floor except for the area where the granite sill of the embrasure can be seen. Comparison with a photograph of a near-contemporary battery in Fort Popton, Milford Haven (Hughes 1991, 193) shows that the gun floor in this fort has a similar slab in each embrasure forming the loading step for the muzzle loading guns, with the floor beyond the embrasure composed of compacted earth except for the sets used to secure the racer and traverse rails. The compacted earth noted at Cliffe may have been covered with stone slabs, the type of flooring suggested by Wilson (1963, 185) in his account of the Thames forts.

Embedded in the floor adjacent to the sandstone pier marking the rear of Casemate 8 is a wrought iron loop. A square aperture left in the later concrete floor indicates the position of the loops in the remaining gun casemates. These loops were provided for the emergency hand traversing of the gun (V Smith pers com).

Figure 18: Interior of Casemate 4 looking towards the shield and embrasure. Note the two cheek pieces to the shield face, two sets of mantlet bars and the granite base at the foot of the shield. Just visible flanking the casemate are the edges of the later concrete traverses filling the gun positions of casemates 3 and 5. (DP097600)

Casemates 9 to 14

Casemates 10, 12 and 14 accommodate three gun positions at the south-western end of the battery that face across the bend in the river. The three gun positions are more widely spaced than positions 1 to 8, either to accommodate the curve of the shoreline and the traverse of the guns or possibly as a legacy of the intention to install Moncrieff pits at this point (see Chapter 5). As a result the granite pier between each gun position is correspondingly longer, making casemates 9, 11 and 13 blind, and the sandstone arch over the shields is larger than the examples in the north-eastern casemates. However their construction is the same (Fig 19). The vault over the gun positions is still cruciform but returns to a barrel vault running east-west in the blind casemates between each gun position, springing from the longer piers. Ceramic vent pipes for each position are set into this vault. The absence of the later concrete traverses beyond casemate 9 preserves the open aspect of the gun floor and shows how all of the gun positions would originally have interconnected. These casemates retain the same loops, mantlet bars, hoists and ammunition supply arrangements as casemates 1 to 8. Fighting light mounts or the scars thereof are located in casemates 10 and 12.

Unlike the lower numbered casemates, the floor throughout casemates 9 to 14 is composed of poured fine-grained concrete extending from the rear of the embrasures into the living areas at the rear of each position. Differentiation between this slab and the granite sill can be seen in casemate 12. Carefully delineated edges around all the embrasures and square cut–outs around the positions of the ammunition shafts

suggest that the concrete floor is a later addition carefully poured to retain access for the vital areas for gun operations. Similar shaped cut-outs around further floor-mounted gun traverse rings at the rear of casemates 10 and 12 also suggest that these functional areas were masked off to prevent them being covered in concrete.

Figure 19: Interior of casemates 10 to 14, looking south showing the open casemated gun floor on the west side of the battery. The change in the direction of the vaulting between the gun positions and the elongated piers of the blind casemates can be clearly seen as can the gun slinging hoops set in the vault and the course of the removed racer rails in the floor. (DP097616)

Casemate 15

Casemate 15 at the south end of the casemated battery is blind like casemates 11 and 13. The exact function of this casemate is not clear. Positioned between the casemated and open batteries, it may have been intended as bombproof living quarters for the gunners of the 9-inch RML open battery. Its position at the south end of the casemated battery also suggests a secondary function as a buffer to absorb any enfilading shot from warships that had evaded the main batteries of Cliffe and Coalhouse.

The interior of Casemate 15 is vaulted; north-south at the front (west end) of the casemate and east-west at the rear. The transition between the vaults is marked by brick piers with stone quions. In the north wall of the rear section a fireplace is offset to the west. Examination of this area shows that both the brickwork and the quoins are disturbed and reset. The fireplace may also have been moved, as the vent above is not level and has slivers above the lintel, a feature not found elsewhere in these carefully constructed casemates. In the south wall, offset to the east, a segmental headed doorway opens into the passage that runs at the rear of the open battery. This entrance has a set back to accept a timber doorframe. On either side of the doorway a row of holes set at 1m above the current floor level, including the ends of four cut back iron brackets on the west side, indicate the position of shelves provided for the living quarters.

Comparison with the 1886 plan of Shornemead (TNA: WO78/4369) and the 1898 plan of Coalhouse (TNA: MPHH1/171) shows that these forts also had a similar blind casemate adjacent to their open batteries providing a route between them and the casemated battery. These blind casemates were divided from the adjacent casemate by a removable timber wall and from the open battery by a small room with masonry walls and an entrance into the open battery passage. In the opposite wall to this entrance was a short tunnel running through the traverse at the rear of the open battery to open onto the rampart in the interior of the fort.

In a similar fashion to Shornemead, the west half of Casemate 15 at Cliffe was, presumably, originally divided from the gun position in Casemate 14 by a removable timber partition wall. This has been replaced by a brick wall extending to the crown of the vault and built in a redder brick than the surrounding earlier walls. On plan it is noticeable that this wall has been constructed at an acute angle, probably to retain working space around the ammunition lift on the south side of the gun in Casemate 14. In Casemate 15 the resulting awkward junction of this wall with the earlier wall in the eastern half of the casemate may account for the reset brickwork and fireplace mentioned above. The construction of this wall may have been intended to reinforce the vault for the installation of quick-firing gun positions on the roof above in the late 1880s or early 1890s (see Chapter 9). The two large holes pierced in the casemate floor and a corresponding hole in the vault over the eastern half of this casemate are evidence for the Brennan installation's rising observation tower constructed in the late 1890s (see Chapter 10). At the south side of the casemate is a counterpart to the inserted north wall: it uses the same colour brick, probably intended as further reinforcement for the installation of the quick-firing gun positions on the roof above. The construction of this red brick wall may have required the demolition of a room similar to that interposed between the casemate and the open battery depicted on the plan of Shornemead (TNA: WO78/4369).

From the physical evidence it is very difficult to detect if a corresponding entrance and room to the one depicted at Shornemead existed at Cliffe. Fragmentary indications survive in the passageway at the rear of the open battery around the area of the junction with the south wall of Casemate 15. The short tunnel noted at Shornemead has a counterpart at Cliffe which runs due east from the open battery passage to the top of the rampart. At the west end of this tunnel, at its junction with the open battery passage, is an area of disturbed brickwork in the passage vault. This may mark the former location of an entrance in the opposite wall which would open into the area between the south wall of Casemate 15 and the north wall of the open battery; however there are no signs of an entrance, such as scars or joints, in the corresponding section of this wall. It appears that the area behind this wall is a void (either open or filled) extending from the inserted south wall of Casemate 15 to the north wall of the ammunition passage for the northern emplacement of the open battery. The void is 3.5m long and 6.25m wide leaving adequate space for the type of room noted at Shornemead. A larger Casemate 15, subdivided into rooms, may also explain the short section of dwarf wall in the floor of its west half immediately to the west of the quoined corner. This wall runs north-south and is built in a poor quality yellow brick, as opposed to the red brick of the surrounding dwarf walls. Its spacing and alignment suggest that it might have carried a timber floor running beneath the present south wall.

Fixtures and fittings of the gun emplacements

Iron shields and embrasures

Each embrasure was provided with an armoured shield intended to protect the gun crew against ricochet and fragments of shot . The documentary evidence shows that the shields were installed in two campaigns, the shields in casemates 1-8 being installed in 1871 (TNA: WO30108/93) and the later shields being delivered in late 1872 and 1873 (TNA: WO30108/163; see Chapter 5). The shields installed at Cliffe, Coalhouse and Shornemead marked the end of a long period of development that had started with trials of simple armoured plate shields in the 1850s and evolved in concert with warship design. Like the armour of contemporary iron-clad warships, the shields are a complex composite of materials designed both to absorb shot and maintain structural integrity under the impact. Experiments in the 1860s and 1870s found that the use of timber as a resilient material behind the armoured plate shield was of vital importance (Brown 1997, 75). This design of shield with its associated mantlet fittings was still being installed in 1876-78 in the last British-built casemated battery at Fort Delimara, Malta, for 38 ton RMLs (Hughes 1991, 199).

All the surviving shields are the same, with two minor variations. The ironwork of the frames installed in 1872/3 is of slightly heavier construction, particularly the brackets that attach the frame to the embrasure, and the shields in casemates 9 to 14 have a variation in length to allow for changing arcs of fire in the gentle curve of the battery. The shields were 4ft (1.21m) thick and consist of two sections; the external face of the shield, a piece of rolled, tempered and treated wrought-iron armoured plate, and an internal frame of rolled wrought-iron plates and sections riveted together. A contemporary description notes that the exterior shield is no greater than 6in thick and no larger than 15ft by 4ft, the maximum size for armour plate at this time. This section of armour is backed by a resilient layer formed of wrought-iron plate interleaved with oak or teak boards. All of this is attached to the internal frame with the space between filled with concrete (Brown 1997, 36).

From the exterior of the fort the armoured plate is visible, set back into the second order of the granite arches. The plates differ in length from a minimum of 9ft in Casemate 14 to a maximum of 15ft in Casemate 10. All the plates have a centrally-set embrasure which is rectangular in shape with rounded corners. Within the embrasure the soffit and faces of the wrought-iron and timber layers are carefully profiled to form sharply-angled splays. The multiple layers of the shield are clasped together with substantial specially manufactured bolts (Brown 1997, 36), the mushroom heads of which can be seen on the external face of the shield. The nuts are obscured by the frame.

The interior frame is a composite of further wrought-iron plates, angle sections and concrete. It is not clear if this is iron concrete, a mixture of iron filings, bitumen and concrete reputedly used in these shields (Brown 1997, 64). The inner face of the frame is composed of two large iron plates riveted together. The upper plate has an arched cut-out with a compound curve for the embrasure and gun muzzle. The top of this plate is riveted to an arched former which fits under the masonry arch.

The bottom plate has a cut-out for the sill section. The two plates are combined by large cheek pieces riveted across each plate. The whole face plate is attached to the armoured shield by substantial L-shaped angle brackets riveted to both frame and shield. These L-brackets space the shield from the frame, form the sides of the inner embrasure and act as mounting points for the smaller non-ferrous mantlet bars that pivot in the embrasure. The space between the shield and frame is filled with concrete as indicated on the 1899 plan (TNA: WO78/4963) and by the careful examination of the holes pierced by explosive charges through the near-identical examples at Shornemead Fort.

Shield Fixtures and Fittings

The shields are provided with two sets of fittings: one set provides assistance with loading the guns while the other provides protection to the gun crew from shrapnel and splinters (Fig 18).

Loading Bars

The loading bar acted as a slinging point for the pulley and ropes used to raise and then swing the shell into the muzzles of the 11 and 12.5-inch RMLs. Each of the casemates in Cliffe is provided with two bars running parallel to the inner face of the embrasure shield. The larger of the two bars, a solid length of wrought iron with a circular cross-section, runs across the face of the shield immediately below the top flange. Its ends are secured into the masonry arch with angled plates and bolts. Immediately above it is a shorter and thinner bar (the length of the embrasure opening) mounted in two ring bolts let into the face of the shield above the embrasure. The thicker bar is present in all of the surviving casemated gun positions while the thinner bar remains in casemates 2 and 4 but has been removed in the other casemates leaving only the ring bolts.

The provision of two lengths of loading bars may relate to an addendum to the List of Changes for 1878 which refers to the pulley blocks (treble blocks) for the shell loading tackle for RML guns mounted in casemates with shields. It notes that the forts at Hurst Castle, Coalhouse, Cliffe, Shornemead, Garrison Point, Landguard and Risacoli and Delimara on Malta, all of them fitted with the latest pattern of shield, require a modification in the standard equipment, in this case the loading bar and the associated pulley tackle, for the gun positions within these forts (V Smith pers comm). Given the variation in design and dimensions for mantlet bars and some racer positions that have been noted at Cliffe from the standards quoted by Moore (1996, 32), one can assume that the installation of the new pattern shields may have required other standard fittings and fixtures to be modified.

Port Bar

As a further aid to the gun crews the Port Bar, a pivoted iron frame, was provided in the mouth of each embrasure to act as a rest for the rammer and other gun tools during cleaning and reloading (Moore 1996, 32). Pivots for this frame, in the form of two small ring bolts set in the soffit of the embrasure, are present in casemates 2 and 4.

Shield Doors

Contemporary descriptions and recent observation of Coalhouse and Shoremead forts strongly suggest that each shield embrasure was provided with a door secured by internal catches. Complete doors transferred from Garrison Point Fort, Sheerness, were installed at Coalhouse (V Smith pers com) and the catches for the doors are still visible in several casemates at Shornemead. These catches are not visible at Cliffe and it is not clear if they were ever installed.

Mantlet Bars

The gun crews were provided with protection from splinters and shrapnel by mantlets. In common with similar batteries, each casemated gun at Cliffe was provided with a two part mantlet, a protective curtain of woven rope intended to prevent shrapnel flying into the casemate if the exterior armour plate was struck. The large mantlet was hung from substantial wrought-iron rods. In turn these were suspended from the soffit of the casemate by two iron ring bolts, each bolt composed of three separate forgings wedged into a shared hole in the soffit of the masonry arch. The wrought-iron bars held in these ring bolts extend back into the casemate and are angled to reflect the angle of traverse of the RML. Hung from these rods was the mantlet, secured at its top by small hooks let into the soffit of the arch, examples of which (or their remains) can be seen in all the surviving gun positions (Fig 18). The rope curtains were made in a variety of shapes to suit different forms of shield. They were soaked in a solution of chloride of calcium to prevent them being ignited by the flash of the gun (Moore 1996, 25).

Set within the embrasure and pivoted in the L-section brackets and the sill, are smaller non-ferrous mantlet bars. Intended, like the large wrought-iron bars, to take a rope curtain, these bars pivoted to allow the rope curtain to follow the muzzle of the gun as it traversed. The rope curtains were suspended on a gibbet-style bracket extending from a pivot composed of 20 non-ferrous pulley wheels threaded on a vertical axle. It is believed that the purpose of these wheels was to retain the rope curtain in tension as the arms moved with the muzzle of the gun.

As with the shields, every surviving gun position exhibits some evidence of the mantlet bars. Casemates 4 and 12 have a full set including the angled support bars for the large rope mantlet. Casemate 2 is the most denuded with only a single bar and the smaller pivoted bars remaining.

Racers

Racers are curved tracks set into the floor of a gun emplacement which enabled guns to be traversed more quickly. Racers of 10-inch or larger RMLs are flanged rails made from steel, supported on iron chairs or set in granite blocks (Moore 1996, 58).

The 11-inch RMLs

In common with all casemated batteries the guns at Cliffe were set out with imaginary pivot points ('A' Pivot) held to be in the centre of the shield (Moore 1996,

58). The 1899 plan (TNA: WO78/4963; App Fig 2) clearly shows these points with rays indicating angles of traverse emanating from them. The 'A' pivot usually gave a field of fire of 70 degrees but the 1899 plan shows that the 11-inch RMLs at Cliffe could traverse through to 50 or 60 degrees depending on position, probably to allow for the gradual curve of the face wall. From the pivot point the steel flanged-rails for the racers should be set at radii of 8ft (2.43m) for the front and 18ft (5.48m) for the rear slide (Moore 1996, 58). Measurements from the 1899 plan show that the dimensions for the 11-inch RML racers are correct, as drawn, for all the remaining 11-inch positions. As part of later work on the battery, casemates 1, 3, 5, 7 and 9 were filled with concrete but it can be assumed that they originally contained the same racers, shields and guns as described for casemates 6 and 8, the two 11-inch RML casemates which remain in the most complete condition.

Casemate 6 has the scars of two concentric semi-circular parallel racers visible on the floor at distances of 1.38m and 4.35m from the shield face. Adding 1.21m for the shield width to each measurement produces 2.59m and 5.56m, approximate with the recommended distances for the 11-inch RML racers. The outer racer retains the toothed rail that meshed with the gear wheels of the traversing mechanism on the gun carriage. The racer nearest to the shield is missing, leaving a scar that extends into granite sets flanking the embrasure, but the central section has been removed and backfilled with cement mortar. The presence of the granite sets and the spacing suggest that these are original racers for the 11 RML. A third shallow mark set at 6.69m shows the position of a graduated training arc. These were usually made of brass.

The gun position in Casemate 8 has the remains of two racers embedded in its screeded concrete floor (Fig 20). These racers are at 1.32m and 4.36m from the inner face of the shield which is 2.53m and 5.57m when adjusted to allow for the width of the shield. A narrow slot for a training arc is at 6.68m (adjusted). The training arc extends beyond the limit of the concrete floor in the northern portion of the casemate. This projection suggests that another floor surface has been removed, perhaps a timber boarded floor.

Casemate 10 exhibits two racers with granite sets at the right spacing for 11-inch RMLs. The racer scar 2.52m (adjusted) from the shield retains a ferrous strip which stands proud of its mortar setting. The 5.48m racer (in this case measured at approximately 5.75m (adjusted)) is visible as a cement-filled channel in an arc of granite sets each 0.6m wide. A further series of racer scars set in concrete at different centres to the recommended dimensions for the 11-inch RML without any evidence of granite or iron chairs suggests that they are a later modification associated with the remodelling of the gun floor in the 1870 or 1880s (see Chapter 9). The gun floor to Casemate 12 exhibits a similar set of alterations to that found in Casemate 10. The original racer rail positions are still visible: a ferrous racer, 6.5cm wide, is set within a bed of mortar 22cm wide which itself is set within a pecked sandstone floor and located 1.20m (2.41m) from the face of the gun port. The second racer rail is indicated by a cement filled channel describing a smooth curve and set in an arc of rectangular granite flags, 0.61m wide.

Figure 20: The remains of two racer rails for the 11-inch RML embedded in the floor of Casemate 8. The narrow slot for the training arc extends beyond the limit of the concrete floor in the northern portion of the casemate, suggesting another floor surface has been removed, perhaps timber boards. (DP097607)

12.5-inch RMLs

Documentary sources (particularly *The Times*, 30 May 1877, 6, col 3) show that 12.5-inch RMLs were being installed in 1877. They were supplied to Coalhouse and Cliffe forts to cover the area around Mucking Flats on the Essex bank of the Thames, opposite Hope Point (Wilson 1963, 187). The 'Revision of Armaments Thames and Medway Forts' report of 1 April 1889 (TNA: WO396/4) noted that these guns were mounted in casemates 1 and 2. It then proposed that Casemate 1 be converted to a traverse and the displaced 12.5-inch RML moved to casemate 3. The 1899 plan (TNA: WO78/4963; App Fig 2) shows the gun was actually moved to Casemate 4 with casemates 1 and 3 as traverses (see Chapter 9).

The racers for the 12.5-inch RML were steel with no flange and set out from the notional 'A' pivot at 10ft inner and 20ft or 21ft, depending on recoil, for the outers (Moore 1996, 58). The 1899 plan shows no racers set at these dimensions but does show an additional racer in casemates 2 and 4 set at 12ft from the 'A' pivot (TNA: WO78/4963). This may be evidence of the remounting of the 12.5-inch RMLs during the modifications of the 1880s, perhaps on purpose-built or modified 11-inch RML

carriages, to which the inner racer measurements conform. Survey of casemates 2 and 4 revealed that the casemated positions for the 11-inch and 12.5-inch RMLs did not differ from each other. Details such as the construction, shields and fittings are identical between them. Unfortunately no evidence for racers remains in Casemate 2. Casemate 4 retains a scar in the floor for a single racer set at the distance for an 11-inch RML, along with a groove in the masonry to the east of the edge of the wrought-iron shield frame which could be to accommodate the increased width/ traverse of a 12.5-inch RML mounting.

Lifting loops

In the vault of each casemate, set along the centre line, are three massive iron loops. Comparison of identical examples exposed by the part demolition of Shornemead Fort shows that each of these loops is forged from a single 2in diameter iron bar descending from an iron mounting plate set at a depth of 1.25m into the bombproofing layer over the casemates. These substantial loops were intended to aid the mounting of the gun, anchoring the pulleys that were used to swing the barrel onto its carriage (Moore 1996, 24). Measuring from the notional pivot point on the outside face of the shield, the loops at Cliffe are set at 6ft 8in (2.03m), 9ft (2.74m) and 19ft (5.79m) which, apart from the first loop, correspond with the values given in tables of dimensions for the 11-inch RML – 9 ft (2.74) and 19 ft 6in (5.94m) respectively (Moore 1996, 58). The presence of the additional loop may be accounted for by a footnote that the positions of loops could vary according to position and the centre of gravity of the guns. The installation of the new type of shield may also have required an alteration to the dimensions.

The Living Casemates

Placed in casemates immediately behind each gun position are the living quarters for the gun crews. Evidence to the 1869 Committee by Captain Silborne RE (House of Commons 1869, App 3) makes it clear that the casemates were intended as living accommodation only during time of war, when the fort would be fully armed and manned. Nevertheless the emphasis on living standards, following the report of the 1858 *Royal Commission on Barracks and Hospitals*, meant that each casemate had to be properly ventilated and provided with a living space of 600ft^3 per man (Douet 1998, 14). The rear wall of each living casemate was formed by a removable timber partition incorporating a centrally-placed door flanked by windows. Before the gun came into action these partitions would be taken down to provide ventilation to the gun floor and to remove the hazard of glass and wood splinters if the casemates were hit by enemy fire. Soon after the completion of the casemates additional timber partitions were provided to stop draughts from the gun positions entering the living quarters. Details on a plan dated 26 July 1887 show that the head rail of the partition was fixed to the vault of the casemate but to prepare the casemate for action all the subsidiary rails and planks could be quickly knocked down with hammers (TNA: WO78/2601).

The living casemates extend southwards and eastwards from the sandstone quoined pillars that provide the springing for the cruciform vault of the gun positions and

the inner end of the barrel vault of the living casemate, marking the transition from gun space to living space. Running across the vault at this position is a groove, representing the location of the removable timber partitions between the gun position and the living casemate. All the living casemates have brick-built walls and a barrel vault (all in English bond) springing from the walls at a height of 6ft (2m) in each casemate. Set in the crown of each vault is a ceramic ventilator pipe. In common with those in the crown of the gun positions, study of Shornemead Fort shows that these vents also performed a 90 degree transition and then ran in the bombproofing above the vault emerging at wrought iron grilles flanking the brick-built arches forming the front of the living casemates. The casemates end at a semicircular arch with an inner rebate 12cm (one brick) deep to locate the removable timber framing of the partition wall. An omitted brick at the apex of the vault marks the position of a securing wedge for this removable wall. The arches are set within a wall of English-bond brickwork 16ft (4.88m) high with the top courses providing a parapet to the concrete and asphalt roof of the casemates. The doorways in the timber outer walls of the casemates opened onto a 4ft (1.22m) wide walkway running along the top of the earth rampart mounded over the basement light passage.

Fireplaces and Flues

Set in the west or south walls of each casemate is a fireplace and an associated vent (Fig 21). Each fireplace has a three course segmental head and a stone hearth. Set in the vault above every fireplace, beneath a sandstone lintel, is a rectangular vent or an indication of its former presence, evidence of a flue system designed to ensure air circulation in the casemate. The full layout of this system could not be established by the examination of the fireplaces and vents in Cliffe Fort but close study of the same areas in the partially demolished Shornemead Fort has provided evidence for the internal structure which appears to have been a simplified version of the Nettleton or Arnott's Stove and Ventilating Grate which was adopted as standard in military accommodation after 1857 (McDonald 1983, 201). Two flues rise from the top of the fireplace, one a ceramic pipe eventually connected to the chimney pot, draws in the smoke and performing a 45 degree transition runs up through the bombproofing to a stack set in the parapet wall; the chimney pots are indicated by a black dot on the 1899 record plan (TNA: WO78/4963; App Fig 3). In front of the ceramic pipe a shallow slot, rectangular in section, has been left in the brickwork. Evidence from the gorge ranges (see Chapter 8) suggest this carried an iron box-section flue allowing warm air to enter, hopefully without the smoke, and then rise out of the wrought-iron grilled vent at springing level, thus heating the top of the casemate. Cold air is drawn into the grate by an earthenware pipe that runs under the floor from an iron-grilled vent at the foot of the casemate front wall. Examples of open fireplaces and vents can be seen in casemates 4, 5, 7 and 9. Casemate 12 has an open flue but a blocked fireplace and casemate 7 has the brick surround and stone lintel for an economy grate inserted into the fireplace. Fragments of similar stone lintels in casemates 5 and 10 suggest that economy grates were also inserted in these.

In all the living casemates except for 2 and 4, possibly due to the mounting of the

larger 12.5-inch RMLs in these casemates, twelve L-shaped iron hooks or their stubs can be found regularly spaced and set in a horizontal line in the mortar course just below the springing of the vault. Similar hooks can be seen in casemates at Shornemead and Coalhouse Forts. A note on the 1897 plan of Coalhouse Fort refers to the reinstatement of hammock hooks in casemates 12, 18, 16, 21 and 22 and given that the hooks at Cliffe are found in both walls allowing a hammock to be slung across the casemate, this is the probable explanation for their presence (TNA: MPHH 1/171). The stubs of brackets for the standard accoutrement rack, a combined shelf and equipment hanger frequently found in the living quarters of Victorian soldiers, can be seen in casemates 1, 6 and 12. A more detailed description of these racks can be found in Chapter 8.

Figure 21: Detail in Casemate 5 of what is thought to be the original fireplace and air vent for the living casemates. The edge of a concrete traverse, painted orange brown, can be seen on the right of the picture. (DP 097601)

Floors

Suspended timber floors for the living casemates are depicted in section on the 1899 record plans (TNA: WO 78/4963) with the boards of the floor resting on a transverse joist at the rear of the gun position and running to a stepped coping stone that provided the footing for the removable timber front wall of the living casemate. The removal of such a floor is suggested by the height of the unconsolidated floors in casemates 7, 8, 9, 10 and 11 which are all at a noticeably lower level relative to the later concrete slab in the associated gun positions. In Casemate 6 concrete ramps have been provided to bridge the change in height between the floor surfaces, presumably once the timber floors had been removed.

The Open Battery

So termed because the guns were only protected by traverses and an embrasure rather than the brick vault of the casemated battery, the open battery consists of two positions located at the south-western end of the casemated battery. One position is depicted on the 1899 plan with the legend '9-inch RML 12 ton Open battery' (TNA: WO78/4963; App Fig 2). Armament returns for the fort and various reports (Wilson 1963, 186) list two 9-inch RMLs on 'A' pivot mountings as allocated to Cliffe until

the 1890s. Coalhouse and Shornemead Forts mounted 9-inch RML open batteries of four and three guns apiece (TNA: MPHH 171/1). This smaller size of gun, relative to the casemated 11-inch RMLs, was used to enable the guns in this open battery to rapidly engage any enemy vessel which had evaded the fire of the main batteries at Cliffe and Coalhouse and was determined to make a run up stream. The open embrasures gave them a wider field of fire and they could be quickly aimed, traversed and loaded by hand. The casemated battery would protect them from broadside fire. Between 1888 and 1900 the guns were removed and the positions modified for mounting the Brennan torpedo; eventually both positions were roofed over (see Chapter 10; App Fig 8). The north position has been extensively modified for use with the Brennan torpedo and retains little evidence for the gun position. The south position retains some components of the open gun position including the embrasure and the ammunition supply arrangement.

From the exterior of the fort the open batteries could originally be detected by deeply-splayed openings in the granite wall. Above this was a concrete cap; study of the battery at Shornemead shows that this is faceted and slopes back from the granite face wall to a narrow parapet. At Cliffe these are now obscured by later modifications but the course of the splay and the depth of the embrasure can still be seen when standing on the present roof. Comparison with surviving examples at Shornemead, Coalhouse and Tilbury forts, along with the plan of the south position on the 1899 plan (TNA: WO78/4963; App Fig 2), show that the deep splays in the face wall ended at a substantial granite sill, with the sides of the embrasure formed from profiled brick-built walls. Demolition of sections of the Shornemead battery shows that the space beneath the faceted concrete cap and behind the granite block face wall is filled with rubble and concrete.

As built, the positions were provided with substantial traverses to compensate for the absence of the bombproof casemate. The example at Shornemead takes the form of a concrete and rubble core retained by walls of English-bond brickwork capped with a layer of concrete and asphalt. At Cliffe the brickwork walls of the traverse are virtually identical to those at Shornemead. The largest traverse runs at the rear of the position closing the gap between the ragstone wall marking the end of the casemated battery at Casemate 15 and the south-west demi-bastion. The top of this wall is capped with granite sets retaining the concrete and asphalt topping. At right angles, allowing for the gradual curve in the trace of the fort at this point, to the rear traverse are further brick and concrete traverses forming the outer walls of the open battery and the dividing wall between its two gun positions. Pierced through each of these traverses is a tunnel with a semicircular vault allowing a passageway to run the length of the open battery parallel to the rear traverse; this passageway connects the two gun positions and the ammunition passages. The ammunition passages are also vaulted and run into the centre of the traverses, ending at the ammunition lifts which are located deep within these structures for protection. The passageway emerges in the south wall of casemate 15 from where the casemated battery could be reached. At its south end the passageway ends in a lobby located in the end traverse. This lobby serves the ammunition passage and has doorways opening onto the terreplein of the fort, via a flight of steps, and into the store room located within the south-west demi-bastion.

The south gun position retains the most evidence for its use as a 9-inch RML position (Fig 22). Given the similarity in layout and appearance between it and the open positions in Coalhouse and Shornemead forts it is safe to assume that the extensively altered northern gun position originally had the same appearance.

Within both gun positions the brick-built traverse and embrasure walls rise to a brick cordon of two courses above which is the concrete and asphalt topping. The subsequent roofing over of the positions removed this cordon from the north position. Located in each traverse wall, adjacent to the tunnel entrances, are set backs with semicircular heads of two courses of brickwork. These are present in all the examples of open batteries in the Thames forts and appear to coincide with the ends of the rear racer for the 9-inch RML carriage. The recess may have provided working space for the gun crew swinging the carriage through its traverse. Immediately to the west of these set backs are substantial sandstone mounting blocks for large cast-iron rings that anchor the pulleys used to traverse the gun. The rings are still in place in the south position.

Figure 22: The southern former open gun emplacement looking north towards the second open emplacement. The blocked brick gun embrasure can be seen to the left of the image whilst the ring and set back associated with traversing the gun can be seen to the right adjacent to the passage which connects this emplacement to the one to the north. (DP097650)

At the front of each position was the wide brick embrasure with profiled sloping sides giving a generous arc of fire for the gun. The substantial granite block forming the sill of this embrasure and fragments of brickwork incorporated in a later blocking are still visible in the south position but the entire face of the north position is hidden behind later concrete walls related to the Brennan torpedo installation. Comparison with the 1899 plan (TNA: WO78/4963; App Fig 2) and Coalhouse and Shornemead

shows that a masonry loading step should be present at the foot of the embrasure. It is possible to see an outline of this step in the later concrete floor of the south position.

The floors in both positions have been relaid with poured concrete obscuring any evidence for the racer rails. A pronounced downward slope to the rear of the south position suggests that the original floor level is retained in the passageway. Also visible to the rear of the casemate is the edge of the asphalt waterproofing recommended in the letter of 1873 (TNA: WO30108/188) extending up the walls to make a weatherproof seal. The 1899 plan (TNA: WO78/4963; App Fig 2) shows that the south position had two racer rails at the recommended distances for the 9-inch RML and a brass, graduated training arc.

Ammunition Supply

Three ammunition passages are apparent, one at each side of the battery and the third in a passage in the traverse between the gun positions. The only fully accessible ammunition passage at the time of survey was the passage for the southern gun reached from the connecting lobby to the south-west demi-bastion.

The southern vaulted ammunition passage slopes downwards towards the front of the fort, ending at the head of a shaft that pierces the bombproof vault and emerges in the shifting passage below the battery. The head of the shaft is set in a recess in the passage end that allows space for suspending the lifting tackle for the shells over the shaft and for its winch mechanism. The recess is beneath a very substantial sandstone lintel rising into the crown of the vault; this lintel spreads the weight of the concrete and rubble filling and the concrete capping. Beneath this is a further sandstone slab with a wrought-iron strap in its soffit for suspending the pulley mechanism for the ammunition hoist over the shaft head. Halfway up the left jamb is a further recess with another substantial lintel that housed the winch mechanism for the ammunition lift. This example retains the cast iron bearing block for the mechanism bolted to a sandstone sill. This differs from the arrangement in the 11 and 12.5-inch gun positions where the winch is positioned in the basement. Set in the wall immediately to the left of the hoist recess is a speaking tube connected to the passage immediately below.

The corresponding passage for the northern gun position retains the majority of the same features but has been modified for use with the Brennan torpedo position (see Chapter 10). The passage between the guns is very similar but has additional features and has also been modified for the installation of the Brennan torpedo. Additional features suggest it was the lift for shells. The provision of two recesses in the south wall close to the position of the lift would have acted as ready-use stores for a supply of shells whereas under safety rules a similar store of cartridges would not be allowed (Moore 1996, 36).

Artillery Store

Artillery stores were provided to house the tackle, rammers, common spares and useful articles used on a day-to-day basis by the gun crews. An artillery store ‘at the

end of the parapet' is referred to in the report and estimate for Cliffe of 1870 (TNA: WO30107/61). The large room in the southern corner of the south-west demi-bastion is labelled as a store room on the 1899 plan (TNA: WO78/4963; App Fig 2) and a similar room in a corresponding position is labelled as 'artillery store' on the Shornemead plan (TNA: WO78/4369). The room at Cliffe has no internal connection with the other rooms in the bastion but it has an entrance into the lobby at the south end of the passage that runs at the rear of the open battery. Within this lobby is the entrance to the ammunition passage and direct access to the gun floor for the southern 9-inch RML. Immediately to the east of the lobby doorway is another that opens onto the walkway on top of the rampart at the head of steps down to the entrance passage to the magazines for the open battery.

The store room follows the same construction as the other rooms in the south-west bastion with a Fox and Barrett-type fireproof floor and ceiling (see Chapter 8) and unplastered brick-built walls. There are two window openings in the south wall with set backs for sash frames and pintles for mounting internal iron shutters. Against the west wall is a centrally-placed stack and the marks for the timber shelving shown on the 1899 plan (TNA: WO78/4963; App Fig 2) to either side. The provision of a stack in this room and a ventilator in the ceiling raises the possibility that this store could also be used as living accommodation for the gun crew, particularly as the 1899 plan shows that the granite and concrete of the face wall reinforces the west wall of the store, providing protection against shell fire.

The Roof

The original form of the roof over the casemates is obscured by several phases of gun positions, rangefinder and observation positions and the site of the rising director tower for the Brennan torpedo (App Figs 3 and 8). Study of the roof of the battery at Shornemead Fort may give a strong indication as to the original form of the roof at Cliffe. Due to doubts about its strength and stability, Shornemead was never rearmed with quick-firing weapons emplaced on the roof and the remaining section, other than some Second World War additions, is flat, featureless and covered in asphalt. A 1953 aerial photograph (HEA: RAF/540/1015 0106 05-FEB-1953) shows much the same with the now demolished rear section over the living casemates ending at a parapet. The same brick-built parapet wall is apparent at Cliffe, although with numerous patches and alterations. It incorporates the stacks for the living casemates and V-shaped recesses which could be positions for an early form of rangefinder. These recesses appear to be an early, if not the earliest modification, to the roof and are clearly associated with the walkway running below the level of the parapet. This walkway is supported on cast iron brackets which have been inserted above the heads of the living casemates (see Chapter 9).

The absence of any major structure on the roof is supported by an illustration in *The Illustrated London News* (28 October 1876, 419-420) which shows nothing rising above the cordon of the face wall.

8. THE FORT AROUND 1870: THE GORGE RANGES

Gorge Face

The landward side of Cliffe, like most forts of this period, is provided with measures to mount a limited local defence by rifle fire against an assault by an infantry landing party (Wilson 1963, 58). Initial defences consisted of obstacles: a series of ditches running north-south between Higham and Cliffe Creeks, closing the neck of the peninsula; the scarp for the tramway to the south of the fort, running from the pier to the fort entrance, formed a crest to highlight attacking infantry against the skyline making them an easier target for the defenders of the fort, and close into the fort, unclimbable fences, following the course of the ditch, cut the fort off from the shoreline and then ran along the shoreline parallel with the face of the battery (Fig 40).

The face walls of the gorge front (the walls that form the exterior walls of the fort and were likely to be attacked by enemy troops) are built of rough dressed Kentish ragstone laid in regular courses with sandstone copings. The same stone is used for the gorge fronts of Shornemead and Coalhouse forts as it reduces splinters from shot and shell and was cheaper and easier to work than the granite used for the face walls of the battery (Wilson 1962, 186). There is a single entrance in the face wall of the fort; multiple entrances would impair the integrity of the defence. It is located in the centre of the east wall beneath a single order arch with pronounced granite voussiors. The moulded sandstone sills of the rectangular window openings on the ground floor were set 7ft (2.1m) from the original ground surface (TNA: WO78/4963) and, even with the considerable alteration to ground level around the fort, these sills are still noticeably higher than the average domestic building, intended as another obstacle to an attacking force. On the south range the window openings on the first floor are slightly larger compared to the ground floor as the windows were not required to provide an obstacle to attackers and the additional height would give the defenders a better downward field of fire. They also let more light and air into the hospital ward on this floor.

Both the east and south gorge walls are enfiladed by bastions with the intention of preventing an enemy force getting a lodgement against the walls and then detonating a mine or charge to breach them. Only the bastion on the south-east corner of the fort is a true bastion with two faces enfilading the south and east wall. The north end of the east wall and the west end of the south wall are covered by what has been termed demi-bastions in that only one wall of each bastion is loopholed to provide enfilade fire: In the north-east demi-bastion it is the south wall, in the south-west demi-bastion it is the east wall (Fig 23). Originally the loopholed south wall of the north-east bastion, shown as part of the general store on the 1899 plan (TNA: WO78/4963; App Fig 2), was the rear wall of the first casemated gun position and the loopholes were reached from this position. A similar arrangement can still be seen at Shornemead Fort. During the infilling of this gun position with concrete, circa 1889 (see Chapter 9), the general store was created to retain access to these loopholes.

Figure 23: The loopholed flank wall of the south-west bastion looking west
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The gorge walls vary in thickness (TNA: WO78/4963; App Fig 2). The ragstone masonry of the east wall is 7ft (2.1m) thick while that of the south wall is only 4ft (1.5m) thick. The reason for this discrepancy is expressed in the wall thicknesses of the south-east and north-east bastions. The north face of the south-east bastion, which is visible to the river and therefore vulnerable to direct fire from an enemy warship, is 10ft (1.8m) thick and not weakened by the inclusion of loopholes. The south face of the north-east bastion and the adjacent section of face wall for the ablutions and latrines, is sheltered by the north face wall of the battery from direct fire from the river and is accordingly only 4ft (1.5m) thick.

The loophole design used throughout the bastions consists of a rectangular embrasure with the lintel and sill formed from sandstone slabs. In the interior of the fort the splays are of brick while the anti-ricochet sections flanking the firing slot are formed from shaped pieces of sandstone (Fig 24). The exterior anti-ricochet sections are stepped and formed from Kentish ragstone. The majority of the loopholes have the firing slot at the centre of the embrasure. Only a few, intended to cover returns or obtuse angles in the bastions, are built with the slot shaped to allow firing at these angles. Loopholes in domestic areas, such as the canteen, were provided with a shutter that sat in a rebated frame cut into the sill and lintel and completed with rebated sections of sandstone let into the brick splays.

Between the bastions all the windows, with one or two exceptions for rooms such as cells, were provided with iron-sheet loopholed shutters hung on pintle hinges. All

windows originally had a conventional two-part sash frame and those on the ground floor have vertical iron bars set flush with the outside wall. These barred windows appear to be original and are seen on other Thames and Medway forts (Wilson 1963, 186). Presumably the bars are set so that they do not obscure the loopholes in the iron shutters. Close study of the fabric and the 1899 plan and sections (TNA: WO78/4963) has not revealed any provision for removing the sash frames prior to an attack so presumably the glass in the windows would be smashed before the iron shutters were closed and barred.

Figure 24: The interior of a loophole in the southern face wall of the fort. (DP 097575)

The *chemin de ronde* is mentioned in the return of August 1869 and costed at £600 (TNA: WO30/106/127). This walkway runs behind the parapet at the top of the east wall acting as both a sheltered path for a sentry and a firing step for defence. Loopholes were provided by omitting two or three bricks, depending on the position, from beneath the coping stones of the east gorge wall. Clearly shown on the section in the 1899 plans (TNA: WO78/4963) is a sloping sill to allow downward fire. The course of the *chemin de ronde* can be discerned by the remains of stone paving slabs which were set in the brick wall butted against the masonry of the east wall. The 1899 plan shows that the outer edge of the slabs was supported on iron beams and columns but evidence for the base of the columns is not visible on the current asphalt roof. A study of the section on the 1899 plan shows that the Guard Room, cook houses, kitchens and quarters in the service range have flying flues carried in the partition wall and rising in the ragstone exterior wall to avoid obstructing the *chemin de ronde*. The course of these flues can be discerned from the exterior of the fort by small rectangular iron covers for the flue rodding points.

The stone flagged pathway of the *chemin de ronde* was reached by stairs in the south-east corner of the south-east bastion and by another flight outside the entrance to Casemate 1 labelled 'stairs to balcony' on the 1899 plan (TNA: WO78/4963; App Fig 2). The walkway extended from this casemate, followed the trace of the east gorge wall, passed over the entrance and having described the three sides of the south-east bastion, ended at its junction with the fort's south wall. Beyond that point is what is best described as 'a place of arms' on the roof of the officers' quarters in the south range. This area is protected by the extension of the south wall at first-floor level between the east wall of the hospital sergeants' quarters and the south-east bastion. On its exterior face this ragstone wall is provided with blind window openings continuing the articulation of the window openings on the first floor. These four blind openings are also loopholed and added to the available firepower along the south face.

A final element to the defences of Cliffe Fort is two murder holes in the granite vault of the entrance. These holes are carefully shaped, extending from openings set flush with the roof of the east range through the vault of the archway. Defenders would reach the holes via an archway with a single order brick segmental head, set back into the face wall below the *chemin de ronde*. The archway allows the holes to be positioned over the gateway so that any attacker attempting to place a charge against the gate would be subject to fire from above.

The Ranges

The domestic and service accommodation for Cliffe Fort is located behind the gorge face walls. The 1899 plan (TNA: WO78/4963; App Figs 1 and 2) shows that the east range accommodated the service functions such as ablutions, kitchens, stores and the guard room. The south range was divided into officers' quarters and barrack rooms on the ground floor and a hospital on the first floor. Survey demonstrated that both ranges used the same materials, construction methods, fixtures and fittings.

The 1899 plan (TNA: WO78/4963) shows that, in contrast to the 14ft (6.0m) deep concrete foundations of the battery, the ranges of the gorge buildings have modest domestic scale foundations. The ragstone walls stand on stepped-out ragstone footings 3ft (1m) in depth. The internal brick walls stand on brick-built footings of similar depth incorporating a damp-proof course. Further brick-built dwarf walls supported the suspended timber floors. All these walls stand on an aggregate or very loose concrete slab. Between the footings of the various walls and over the top of the slab is a further 3ft thick layer of fine-grained concrete similar in depiction to the blue lias concrete sealing the foundations of the magazines. It is reasonable to assume that it performed the same waterproofing function. A considerable gap, 4ft (1.5m), between this layer and the soffit of the suspended floor allowed plenty of room for air to circulate or water to rise.

The roofs and first floors to all of the buildings in the south and east ranges are constructed on the Fox and Barrett principle of fireproof construction, indeed Barretts were identified as the supplier of joists for the roof in a letter of 1871 (TNA: WO30/108/85). I-section wrought iron joists span the shortest distance between

walls. The space between the joists is infilled with concrete, in this case a loose concrete probably using locally-won material. The concrete is retained by timber laths laid between the beams resting in the angle of the lower flange of the **I**. Any underdrawn ceilings are attached to this timber using further laths and then coats of render and plaster. The concrete roof is covered in asphalt and specifications for this work, based on that carried out at Coalhouse Fort are appended to a letter dated 22 June 1872 (TNA: WO30/108/180):

> The roofs of the gorge buildings are to be thickly covered in asphalte laid over a bed of fine concrete 1 inch thick
>
> The asphlate is to be continuous through the parapet walls under the coping also through the walls of the chimney shafts which project through the roof.
>
> A fillet or skirting of asphalte about four and a half inches high to be raised around the chimney shafts and other projections through the roof.
>
> A water channel of asphalte is to be carefully formed on the concrete.
>
> The asphalte is to be made good to the masonry or brickwork throughout as to render the roof completely impervious to water.

It is not clear if the current asphalt is original, but in areas where it is known that later work took place, such as the removal of stacks or the iron columns for the *chemin de ronde*, repairs are difficult to detect so it is possible the roof covering has been renewed at some point.

Interior Fittings

The selection of interior fittings common to both ranges, either still *in situ* as complete examples or as fragments or scars where they have been removed, reflects two of the obsessions for the military of this period: the use of the latest materials for defence and the provision of air circulation in all barracks and other spaces.

The most prominent fittings are pintles from which hung pairs of wrought-iron loopholed shutters in nearly all of the windows in both ranges (Fig 25). Each shutter is formed from a single piece of wrought-iron plate with a 0.1-0.15m by 0.1m loophole with a hinged cover plate set in the centre and is hung on three strap hinges riveted into place. The pintles for the hinges are mortared into the splays of the window openings immediately behind the inner face of the sash frame. The shutters are held closed with hinged hasps on the outer end of each hinge plate. The hasps are usually on the left hand of the pair and are hinged in a socket formed from the rolled ends of the hinge plate. Similar rolled ends to the hinge plates on the other shutter form the staple.

Accompanying the iron shutters were window sills covered with a sheet of wrought iron, its rolled edge fitting over the inner edge of the sill and anchored into the brickwork below. The iron sill survives beneath a few window openings although

the recess in the brickwork left by its removal is more common. This arrangement seems to be confined to Cliffe, Shornemead and Coalhouse forts.

All the rooms intended for occupation incorporate two pieces of Victorian technology for heating and air circulation, their installation occasioned by the report and recommendations of the 1858 *Hospital and Barracks Improvement Commission* (Douet 1998, 140). In addition to ventilators incorporated into the external walls and identifiable by their grille covers, each room has a ventilator set in the ceiling. This is visible as a large iron drum suspended from the ceiling usually in front of a doorway or, in an irregular room plan, in a corner or in front of a window. The drum is attached to an iron pipe embedded in the roof leading to an air vent in an external wall with an iron grille on the outside.

Figure 25: The iron loopholed shutters in one of the barrack rooms [46]. Note the hinged cover over the loophole at the bottom of the left-hand shutter and the locking hasp on the centre hinge of the right-hand shutter. (DP 097506)

Most of rooms have a brick-built stack of a rectangular plan with the grate positioned beneath a three-course segmental arched head. Numerous alterations have been made to the grates and it is difficult to determine the exact appearance of an original example. Further examples of the simplified Nettleton or Arnott's Stove and Ventilating Grate (McDonald 1983, 201) seen in the living casemates of the battery (see Chapter 7) are evident, again consisting of a ceramic chimney flue pipe removing smoke, an iron box-section flue rising behind the ceramic pipe and ending at a louvred grille above the fireplace, which circulates warm air without the smoke at ceiling level, and a further ceramic flue pipe drawing cold air that runs from a vent at the foot of an external wall to the grate set under the floor or in the thickness of the partition wall. The examples in these ranges do not have a warm air chamber and the accompanying patent grate, although many incorporate a sandstone lintel in the same position above the grate as the slate lintel for the warm air chamber shown on the sectional drawings of the Arnott's stove. Modification and part demolition of the stacks in these ranges has possibly removed evidence for the grates and chambers.

East Range

West Elevation

The original west walls (i.e. the parade ground elevation) of all the rooms in the east range are missing (Fig 26). The neatness of this removal suggest that they were deliberately demolished at a later date to allow the rooms to be used for other functions. At the north end of the range the Ablutions and Latrines retain front walls which have been extensively altered with only the east jamb of the latrine doorway conceivably original. The 1899 plan (TNA: WO78/4963; App Fig 1) suggests that the parade ground walls of this elevation resembled the corresponding walls of the south range, with flat-headed segmental arches to the openings, sandstone sills, sash frames and ventilator grilles set at the head and foot of the wall. All of the rooms, other than specialised rooms (the Ablutions, Cells and Pantry and Mess Kitchen at the south end of the range) had a single door accompanied by a window. Internally all of the rooms are flooded to a level that makes identification of any features, other than the largest and most well defined, in the floor or at skirting height impossible. All the rooms retain enough of their 0.35m (18in) thick brick-built partition walls to allow straight forward location on the 1899 plan. Although most fittings and fixtures have been removed, scars and some fittings, such as flue boxes set firmly in the wall thickness, remain to allow the identification of the position of fittings indicated on the 1899 plan.

Figure 26: The fort interior in September 2010, from the southern range looking north-east. The fort entrance is in the centre of the picture and is flanked by the remains of the east range buildings which have had their front walls demolished. At the top of the gorge wall the loopholes set beneath the capping stones can be clearly seen. The horizontal scar beneath them indicates the course of the removed chemin de ronde. (DP097577)

Rooms

Ablution Room [80]

This room has been extensively altered and any earlier fabric that survived this work has been concealed by plaster. The 1899 plan (TNA: WO78/4963; App Fig 1) indicates a solid cement and concrete floor, a row of wash basins on the north wall and a cubicle for a single bath in the north-west corner. As previously mentioned the thinner gorge wall in this room allows for splayed sills in the window, which retains a sash frame.

Latrines [79]

Like the Abultions, the latrines have been extensively altered and replastered but a stub of the original modesty wall, shown on the 1899 plan (TNA: WO78/4963; App Fig 1), is visible as the west wall of a later cubicle. The 1899 plan indicates a solid cement floor with urinal stalls against the north wall, probably with a slate splashback, and WC stalls against the south wall, running from the modesty wall opposite the doorway to the south-east corner where the last two stalls were reserved for Non-Commissioned Officers (NCOs). In the north-west corner was a pump connected to a well beneath the nearby Lamp Room [74]. Given the extensive correspondence about the brackish nature of the well water at Cliffe (TNA: WO30/106/107) it can be assumed that this pump supplied water for cleaning and flushing duties only.

Cook House [78]

Despite later removal of the front wall, the bricking up of the window in the east wall and later constructions on the concrete floor, this room does retain evidence for the battery of ovens shown on the 1899 plan set against the north wall (TNA: WO78/4963; App Fig 1; Fig 27). Set centrally in this wall is a ceramic flue pipe, below which is a sandstone lintel. Beneath this, and regularly spaced across the wall, are seven iron-framed rectangular openings each measuring 0.18 by 0.13m.

The depiction on the 1899 plan of two chimney pots at roof level above the east wall of this room suggests that these iron-framed openings may be connected to a second ceramic pipe rising through the thickness of the wall. Another ceramic flue has been revealed by the partial demolition of the south wall to make an entrance into the adjacent cells; it was probably connected to a chimney pot, indicated on the 1899 plan of the roof, above the east window of the cell block, although no stack or grate is shown at ground level. Demolition work or structural collapse has obscured any evidence for the 25ft table or bench shown on the 1899 plan and the sink shown beneath the window in the north-west corner.

Figure 27: The north wall of the Cook House. The position of the ovens is marked by the iron-framed rectangular openings. Evidence of later reuse can also be seen in the form of the low concrete wall and red-brick boiler footings. (DP097464)

Cells [76,77]

The fort was provided with two small cells, each for a single prisoner, connected by a shared central north-south corridor to the Guard Room [75] immediately to the south. The 1899 plan (TNA: WO78/4963; App Fig 1) shows that both cells and the shared corridor from the Guard Room had suspended timber floors. The eastern cell retains its high-set barred window in a deep parallel-sided window opening with a sandstone slab sill (Fig 28). Pintles for hinges in each corner of the surviving timber frame suggest that iron shutters were mounted in this window. Externally the cell window appears above a transom at the head of a blind full-sized window opening. In the south wall is a now-blocked lamp box which contained a lamp for the cell which would have been placed behind a metal-framed glass pane from the Guard Room side. The west wall retains sections

Figure 28: The high-set window of the eastern cell. (DP097466)

of the timber frame for the inward opening cell door. The cell on the west side of the corridor is a mirror image of the east cell and its east and south walls remain with the south wall retaining an open lamp box with the vent pipe for the light rising into the wall through a sandstone lintel. The west wall and the south-west corner were later incorporated into a now demolished toilet block and have been rebuilt.

Guard Room [75]

On the 1899 plan (TNA: WO78/4963; App Fig 1) this room, at 24ft (8.0m) by 28ft (9.35m), is the largest room in the south and east ranges, bigger than barrack rooms and the commanding officers quarters. This may well reflect the standard of behaviour expected from the average Victorian soldier as the Guard Room would act as a place of detention once the two cells were full. It also provided sleeping accommodation for the soldiers on guard duty and office space, usually for the senior Non Commissioned Officer (NCO) and the clerks. It is well placed to supervise the only entrance to the fort, as well as the access routes to the barrack stores and the entrance to the ammunition stores in the north-east corner of the basement. The only entrance to this room, other than through to the cells, is in the south wall leading off from the main entrance passage into the fort. Anyone entering or leaving the fort had to go past the Guard Room, usually past a sentry posted outside. Due to the heavy traffic through the entrance the jambs of this doorway are finished with bull-nosed closers, visible in the surviving jamb to the east. In the 1899 plans a section through the Guard Room looking south reveals that the décor was very plain. Although the walls may have been plastered the door to the main entrance passage was utilitarian: planked, ledged and braced with a rounded head. A section of the west parade ground wall survives to window sill height, having been incorporated into the later toilet block constructed across the south-west corner of the adjacent cell block. The rest of the wall has been demolished. In the east wall is the only surviving internal feature of interest, a recess, probably for a safe, measuring 0.49m by 1.82m by 0.5m, with a sandstone lintel and the remains of a slate shelf. It is not depicted on the 1899 plan. The eastern half of the fireplace and stack with grate and warm air vent, all shown on the 1899 section, survives against the south wall. The 1899 plan shows that the room had a suspended timber floor.

Main Entrance

This passage way, 10ft (3.0m), wide provides the only entrance into the fort. Presumably its narrow width made it easier to defend in the absence of contemporary refinements, such as the drop drawbridges found in the Medway forts (Wilson 1963, 186). At its eastern end was a pair of doors set back within the single order granite archway and covered as previously noted by murder holes in the vault. The northern leaf of this pair of doors remains hung on substantial pintle hinges and closed back against the Guard Room wall (see Fig 78). Of the standard design for this era, it has a timber core 11.3cm thick faced with a 5cm thick iron plate secured by rivets. The inside face of the door should consist of raked boarding concealing the hinge straps (Brown and Williams 2001, 48) but its presence on the door of Cliffe Fort cannot be established due to its angle. The 1899 plan (TNA: WO78/4963; App Fig 1) depicts the passageway as cobbled or laid with setts but the area was full of sand and gravel at time of survey and it is impossible see if this covering survives.

Water Tank [demolished]

The water supply for the Cook House [78] and Latrines [80] came from a water tank, located over the main entrance. The 1891 drainage plan (TNA: WO78/3427) labels it 'Main Tank'. The plumbing legend on the 1899 plan (TNA: WO78/4963) shows the supply in a 2in main running down the south wall of the main entrance and then across the northern edge of the parade ground to the Cook House and Latrines. In section, the 1899 plan shows the water tank as rectangular, iron-panelled and supported on two brick-built walls pierced by two openings with semicircular heads. The walls ran east-west, one to each side of the fort entrance, and the tank rose to the height of the parapet wall with the *chemin de ronde* passing between it and the parapet wall. Only the brick footings for the supporting walls survive.

Barrack Store [31]

The room identified on the 1899 plan (TNA: WO78/4963; App Fig 1) as a Barrack Store is remarkably devoid of features, both on the plan and when surveyed, probably because the room was intended for the storage of large domestic items such as bedding and furniture. Its location adjacent to the Guard House [75] may be intentional to allow the store contents to be supervised by the guard. The provision of a stack with the usual warm air flue and the depiction of a suspended floor on the 1899 plan suggests the store could also be used for living accommodation. The incidence of store rooms in the east and south ranges being provided with fireplaces suggests that, other than the strictly functional rooms such as the kitchens and ablutions and those of higher status i.e. the officer's quarters, all the other rooms were intended to be adapted as barrack accommodation for the garrison in an emergency.

Officers' Kitchen [32]

This room is labelled as 'Officers Kitchen' on the 1899 plan (TNA: WO78/4963; App Fig 1) but its description on the 1891 drainage plan (TNA: WO78/3472) as Officers' Servants Quarters (the barrack room for soldiers acting as personal servants to the fort's officers) seems more accurate. Considered as a kitchen this room has several anomalies. It has no direct access to the adjacent pantry and cellar and the stack, as surveyed and depicted, is of the standard domestic size with the conventional sandstone slab lintel set at the level of flue bifurcation with no evidence for a range set in the fireplace. On the west side of the stack are iron brackets which could be mountings for a boiler indicated on the 1891 plan. The only evidence for any food preparation is on the 1899 plan which shows a waste pipe and a sink beneath the window in the west wall but no piped water supply. Unfortunately this wall has been demolished. The only evidence for the connection of this room with officers, other than its location close to their quarters, is a porch, the only one in this range, shown on the plan.

Mess Kitchen [35 with 33 and 34]

The Mess Kitchen is technically part of the east range but the entrance to this room, located in its south wall, opened into the junction of the corridor to the officers'

quarters in the south range and the passage to the mess in the south-east bastion. This kitchen provided the meals for the fort's officers and these would be prepared by the officers' servants using supplies purchased by the individual officers and by the mess. All the officers at the fort, other than the commanding officer, would have been members of the mess and would have paid mess subscriptions (Makepeace-Warne 1998, 226). The evidence for a cooking range survives in the stack in the south wall, adjacent to the doorway. This stack is wider than those found in the living rooms and lacks the warm air vent. The range was located beneath an arched opening now visible as a scar. This larger stack is tied into the wall with iron straps and incorporates a sandstone lintel but there is no evidence for additional flues. A pierced iron bracket to the west of the chimney supported a water tank or boiler. Study of the 1899 plan (TNA: WO78/4963; App Fig 1) reveals the course of a water pipe terminating at this position on the west side of the stack after serving a sink adjacent to the window in the now-demolished west wall.

Accessible only from this room, via doorways in its north wall, were the Pantry [33] and the Cellar [34]. This arrangement allowed the officers' servants in the kitchen to closely supervise the food and more importantly the mess wine and spirits supply. Both rooms are now in a state of collapse, with little evidence for the pantry remaining other than the lower courses of the front and partition walls. The cellar is better preserved with evidence for whitewashed walls. The east wall of the cellar, true to its function, has no window but does have timber noggins for shelves or racks set in the north wall as indicated on the 1899 plan (TNA: WO78/4963). The Cellar has a solid floor though the plan indicates a suspended floor.

Lobby to Officers' Mess Room and Officers' Quarters including WC [36, 37]

As previously noted the doorway in the south wall of the Officers' Kitchen opens into the junction of the corridors to the officers' quarters and the Officers' Mess Room in the south-east bastion. A further doorway to its west opened into a WC, intended due to its location, for the sole use of the officers. The west wall of this WC has collapsed, filling the base with rubble. The east wall remains and has a brick pattern incised into a coat of cement render with bands at the head and foot of the wall. All the fittings for the toilet have been sawn off and removed leaving the stubs of pipework and scars on the walls.

The corridor running southwards to the Officers' Mess Room in the south-east bastion had a suspended timber floor, now removed, leaving a gap beneath a later coat of cement render on the east wall. The corridor ends at the doorway into the Officers' Mess Room. This doorway has an inserted timber lintel underneath a widened door head and the west jamb has been removed leaving knocked-back brickwork.

Officers' Mess Room [37]

The Officers' Mess Room in any military establishment was intended as a room for the garrison's officers to dine in, entertain guests and generally take their leisure away from the men they commanded and the commanding officer. The irregularly-

shaped internal space produced by the trace of the south-east bastion is ideal for this use. It could not be divided into small rooms, such as officers' quarters, as its defensive function required that the area remain open so that defenders could quickly reach both walls. The windows in the room illustrate the previously noted difference between the parallel-sided window in the thickness of the east wall, which would be exposed to naval gunfire from the river, and the thinner, masked south wall which has two windows flanking the stack with shallower splayed jambs (Fig 29). It should be noted that the window openings in both walls are smaller than those in the surrounding ranges and set higher in the walls. This may reflect their function as loopholes intended to provide the defenders with a slightly elevated position from which to cover the crest of the tramway scarp. The position of a suspended timber floor is detectable by a gap in the hard cement render, applied over a coat of plaster, left by the removal of the floor boards and joists.

Figure 29: The interior of the Officers' Mess Room [37]. The remains of decorative plasterwork can be seen on each corner of the chimney breast and on the lower portion of each wall. Patches of ceiling plaster still adhere to the laths infilling the Fox and Barratt type roof. The iron shutters and their sills have been removed from each window opening. (DP 097470)

The higher status of this room as an Officers' Mess is reflected in surviving patches of plaster work and decoration. Remains of decorative plaster work, including a single roll moulding, are found in the north-east corner, on the jambs of the south windows and on the corners of the stack. A large area of plaster survives on the stack, consisting of a layer of render, then horse-hair plaster and then a finishing coat with a top coat of green paint. Flakes of this paint colour and the accompanying

plaster are also visible high on the east and west walls. The same plaster can also be found in the splays of the south windows and this respects the sash frame edges and the holes left by the removal of the pintles for the iron loopholed shutters, implying that it is original. The ceiling is underdrawn and plastered with patches of surviving plaster covered by a dark blue paint or paper.

The fireplace, although of smaller dimensions than the stacks elsewhere in the south and east ranges (probably because its position in the south wall was dictated by the shape and defensive function of the room), has a hot air flue set in the usual position; evidence for a higher quality surround to the fireplace is provided by iron securing straps set in the brick work and marks in the surviving plaster.

South Range

This range is in much better condition than the east range, retaining the parade ground elevation with its door and window openings more or less intact, other than some missing sills (Fig 30). Internally all rooms retain their walls, other than the south wall of the married quarters in the south-west corner which has partially collapsed. The rooms retain a variety of fittings: ventilators, equipment racks, shutters and scars and fixings from timber shelving.

Figure 30: View of the south range across the parade ground. On the left are the single storey officers' quarters with loopedholed parapet above. The two-storey section on the right has the barracks on the ground floor with the hospital above. (DP 097500)

The ragstone exterior wall of the south elevation is very similar to that of the east elevation. The window openings are regularly spaced, rectangular and have flat heads and sills both formed from sandstone slabs. Bars are set in the openings on the ground floor and behind these are sash window frames. Grilles for fresh air vents are present at both the level of the first floor and above the heads of the first floor windows, reflecting the two-storey range behind. The stacks in this range rise straight through to the roof so rodding points for flying flues, as included in the east range, were not required. At the west end of this elevation the wall steps out to form the east face wall of the south-west demi-bastion. The return to this wall forms the south wall of the demi-bastion which then continues to the south-east corner of the fort.

The north elevation of the south range (i.e. parade ground side) is built in English bond brickwork (Fig 30). The rectangular windows openings, all with sash frames or set backs where sash frames have been removed, have three-course segmental heads. The brick heads are of vertically-coursed red-coloured rubbed brick or at the least very well-laid red stock-brick. The sandstone window sills are bull-nosed. The doorways have similar heads to the windows but use a buff coloured brick. The elevation retains a number of iron fixtures and fittings: an ornate lamp bracket on the north-west corner at first-floor level; fire bucket holders outside the officers' quarters and staples forming a fire escape from the first-floor hospital windows (Fig 31).

Subsidence

On 20 May 1868 Lieutenant Colonel Gordon gave evidence on the work carried out at Cliffe Fort since 1860 to the committee appointed to enquire into the construction, cost and condition of fortifications (House of Commons 1869, 145). He told the committee that the concrete foundation slab for the gorge building had first exhibited cracks after heavy rain in October 1865; these cracks had continued to grow but no new ones had begun. The rooms and corridors in the south-east corner [Officers' Quarters, Officers' Mess and the associated corridor] exhibit a range of structural features unique to this area, possibly as a response to settlement cracks caused by subsidence. Doubts about the structural stability of this corner may explain the absence of a first storey above the officers' quarters; the two-storey gorge wall at this point, complete with window openings, suggests that a first floor was intended but abandoned after the extent of the structural problems became clear. Inside the south-east corner all the doors to the officers' quarters and the officers' mess have three-course segmental heads underneath which are substantial timber lintels keyed into the brickwork of the jambs which may simply have been intended to square-off the doorway or may have been intended to reinforce the relieving arches above (Fig 32). Cracks in the walls of the connecting corridor, many running to the ceiling, and smaller cracks in the stacks in the officers' quarters have been raked out and patched with broad straps of a hard cement-based render; this has survived while the surrounding plaster has fallen off the walls. Further cracks, although without the extensive repairs, can be seen in the south-east corner of the adjacent nine-man barrack room [45]. These features suggest that, after completion, this corner of the fort continued to suffer from subsidence..

Figure 31: The north elevation of the south range showing details of the windows and doors and the iron staples of the fire escape. (DP097488)

Figure 32: Reinforced door heads and patched cracks in the north wall of the officers' quarters may be evidence of subsidence of the south range. (DP 097474)

South Range Interior

The 1899 plan and section (TNA: WO78/4963; App Fig 1) show that the officers' quarters occupied the east end of the range with a coal store separating them from the three barrack rooms. In turn these were separated from a suite of married quarters with the accompanying coal stores and WC by the stairs to the first-floor hospital. The hospital had a sergeant's room at its east end, a store, two wards and a kitchen in the centre and a dispensary and lavatory at the west end. It should be noted that the hospital does not occupy the entire first floor, ending halfway along the range at the east wall of the sergeant's room. Beyond this point is the roof of the officers' quarters with its loopholed parapet wall to the south.

Ground Floor

Corridor to Officers' Quarters [42]

The corridor to the officers' rooms extends west from the lobby outside the Mess Kitchen in the east range. The corridor separates the officers' quarters from the parade ground and is entered by a single doorway in the parade ground's south east corner. This doorway ensures that the officers' living space is separated from the men so maintaining the distinction of rank. All the officers' rooms are entered by doorways opening off this corridor. The 1899 plan (TNA: WO78/4963; App Fig 1) indicates a suspended timber floor in this corridor; a noticeable drop between the level of the parade ground and the current floor level confirms that this floor has been removed.

Officers' Rooms [38, 39, 40]

The officers' quarters consist of three near-identical rooms on the south side of the corridor. The officer's room furthest to the east [38] is slightly irregular in plan to allow for the corner where the two ranges meet. In common with the Officers' Mess Room it reflects the higher status of its occupant by having plastered walls; there are patches of horse hair plaster to the west of the window and this stops short on the west wall marking the position of a dresser or backed shelves shown flanking the stack on the 1899 plan (TNA: WO78/4963; App Fig 1). Patches of remaining plaster have salmon pink as the earliest detectable coat of paint. The same beading as in the Officers' Mess Room is present on the outer corners of the stack and iron straps for securing a fire surround are still present set into the brickwork on its face (Fig 33). In the south-west corner, around the standard

Figure 33: A chimney stack in the one of the officers' rooms with remains of the plaster moulding indicating the better quality decoration of these higher status rooms. (DP097480)

large drum-shaped air vent suspended from the ceiling, are patches of blue painted ceiling plaster. The two officers' rooms to the west of the first room [39, 40] exhibit similar features but are more regular in plan.

Commanding Officer's Quarters [41 and 43]

This suite of two rooms is at the west end of the corridor to the officers' quarters. The eastern room [41] is the same size and plan as the adjacent officers quarters and probably formed the living room with an office [43] in the unheated room to the west which has an entrance at the end of the corridor. The living room and office are connected by a door. As with the other officers' rooms, the stack in the east wall of the living room has a mark 1.27m by 0.92m by 0.50m for a fire-surround, holes in the walls at each side of fireplace for wooden plugs securing the cupboards and the sandstone hearth stone indicated on the 1899 plan (TNA: WO78/4963; App Fig 1). On this wall patches of remaining plaster are salmon pink, matching the scheme found elsewhere in the officers' quarters. In the office slightly lower water levels revealed timber plugs for skirting boards.

Coals [44]

This narrow (2.45m (8ft) wide) rectangular plan room has a full-height window with a sash frame, splays, holes for the pintles for mounting loopholed iron shutters and a sill formerly covered with iron sheet. Its small size, location, solid floor and lack of ventilator and stack suggest that it was always intended as a store. The ceiling is plastered using a very sandy, gritty plaster with a finishing skim coat and both this and the bare brick walls have then been finished with a coat of white distemper, a cheaper alternative to whitewash. Overlapping hinge marks on the timber door frame suggest that double doors were replaced by an outward opening single door at some point.

Barrack Rooms [45, 46, 47]

The barrack rooms open directly from the parade ground. The two nine-man rooms have a centrally-placed doorway, originally with a timber frame set in ferrous sockets at the foot of each jamb and located in a brick set back. The doorways are flanked by windows with similar set backs in the jambs to accept sash frames. The six-man room has the doorway in its east corner and a single window to the west. All the barrack rooms were provided with porches and their presence is detectable by marks (lighter coloured brickwork parallel to the jambs and an opened out mortar course which accepted the waterproof covering to the porch roofs) in the brickwork above the door head. Careful probing reveals the porch threshold slabs which are submerged. It was intended to provide these rooms with a cast iron and glass veranda as at Coalhouse but, as the following correspondence shows, this was omitted as a money-saving measure at Cliffe and Shornemead (TNA: WO30/108/180).

> Royal Engineers Office, Gravesend 30 Jan 1873
>
> To the Inspector General of Fortifications

> Sir
>
> I have the honour to report that the wooden porches of the old work at Shornemead are so much decayed that they will not be available for the new work and that an additional cost of £90 will therefore be entailed for that work viz: 16 porches at £15 each. To meet this additional expenditure I beg to recommend that similar porches should be erected at Cliffe Fort in lieu of the glass and iron veranda by which the following saving will be effected: - £105
>
> I forward a sketch of the proposed porches. It is not proposed to erect them except where the doors of living rooms open direct upon the external air.
>
> I have the honour to be, sir, your most obd servant George Wrottesley Lt Col R.E

The 1899 plan and section (TNA: WO78/4963; App Fig 1) show that these porches were still in use at this date and were very utilitarian: a close boarded timber box 7ft in height constructed around the doorway.

Barrack room for nine men [45]

This rectangular-plan room is labelled '9 Men' on the 1899 plan (TNA: WO78/4963; App Fig 1). As recommended by the report of the *Hospital and Barracks Improvement Commission* (Douet 1998, 140) it is provided with heating, air ventilation and racks for personal equipment. The stack is located in the centre of the west wall; the fireplace is still open and has a three course segmental head beneath which is an open grate. Rising from the grate in the centre of the stack is the usual ceramic flue with the box-shaped iron warm air flue to its right. This flue rises to a wide, louvered vent set at the top of the stack. The familiar iron drum-shaped air vent is set below the ceiling adjacent to the doorway. The walls are not plastered but there is evidence of extensive whitewashing.

Evidence for the provision of nine standard barrack accoutrement shelves is visible. The standard 1864 pattern accoutrement shelf had a slatted wrought-iron shelf supported on brackets of the same material projecting from the wall. Below this was a back board with three circular section iron pegs. Each shelf corresponded to a bed space and was accompanied by a further wooden clasp for a rifle to the left of the bed head. They were introduced in 1832 with a modified pattern adopted in 1864 (McDonald 1983, 4). In this barrack room one complete accoutrement shelf survives on the west wall to the south of stack (Fig 34), two to the north of the stack are fragmentary and remains on the east wall suggest a further six bed spaces. Below these units are the wooden plugs for the securing the rifle clasps to the wall, one for each bed space.

Figure 34: The interior of a Barrack Room intended for nine men [45]. The vent above the fireplace and the equipment rack set midway up the wall to the left of the chimney breast are visible. The iron shutters and the accompanying sill have been removed from the window. (DP 097489)

Barrack room for nine men [46]

This nine-man barrack room mostly resembles the previous room. Of note is the awkwardly placed west partition wall which continues into the west window opening in the south elevation, leaving a parallel west jamb rather than the usual splay, unusual in such a carefully laid out and regulated plan. This variation may be connected with the provision of married quarters [49, 50] at the west end of this range and a possible reordering of room divisions to accommodate them.

Barrack room for six men [47]

This is a reduced version of the adjacent nine-men rooms with only a single window in the north wall. It was heated with a stack placed in the centre of the east wall. This is shown on the 1891 plan (TNA: WO78/3472) but omitted from the 1899 plan (TNA: WO78/4963; App Fig 1). The presence of a louvered vent suggests that it is contemporary with the fireplaces in the other barrack rooms and that there is an error on the 1899 plan. Interspaced timber plugs in the face of the stack suggest that two different fire surrounds have been mounted. The fully splayed window retains a sill covered in iron sheet and a loopholed iron shutter *in situ* at the east side of the window. Remains of accoutrement shelves are present in the south wall and the south-west corner of the west wall, with fixing points in the wall and the ends of wrought-iron brackets marking the position of three shelves and their attendant bed spaces against the west wall.

Hospital Stairs [48]

This narrow flight of stairs is located between the barrack rooms and the married quarters at the west end of the south range. It forms a barrier between the barrack rooms and the more domestic married quarters and hospital. This may be intentional or, as the survey of the married quarters has revealed evidence for structural alterations, it may have merely influenced the choice of this corner of the south range for conversion to married quarters.

The doorway from the parade ground opens immediately on to the bottom of the hospital stair. This stair, with sandstone treads on brick risers, leads via a quarter turn landing (now collapsed) to a narrow north-south landing on the first floor. That a doorway intended for use by the sick was not provided with a porch and the narrow turning stair which would, potentially, have made the handling of stretcher cases difficult may suggest the stair is a later insertion or has been altered.

Married Quarters

The Married Quarters are two rooms separated from the parade ground by a corridor with a centrally-placed doorway in its north wall. Leading off the corridor are, at the west end, two living rooms and, to the east, coal stores and a WC [48]. The two living rooms are labelled on the 1899 plan (TNA: WO78/4963; App Fig 1) as Married Quarters No 1 and No 2 respectively and this, along with details shown on the plan, indicates two separate married quarters, providing one room per family. The 1899 plan shows that each room was provided with two cupboards and a fireplace and these items along with a bed, space for a crib and a shared WC and coal store, are included in the description of the standard fittings for each single-room family apartment in the first official married quarters built at Hounslow Barracks in 1861 (Douet 1998, 145). It may be that the Married Quarters [49, 50] were converted early in the life of the fort, if not during its prolonged construction, from rooms intended for a small number of sergeants. It is notable that on the 1899 plan there are no separate rooms for a sergeant adjacent to the men's barracks, a feature usually found in barracks of this era (Douet 1998, 170). The need for married quarters is shown in the 1881 census return which notes three families, all with young children, stationed at the fort (see Chapter 5), also suggesting that a third set of married quarters were required. The 1881 census return lists only seven bachelor gunners stationed at the fort so there would have been several spare barrack rooms available for conversion (www.findmypast.co.uk1881 transcript details for Cliffe Fort, Cliffe at Hoo, Kent accessed 06/01/2011), obvious candidates would be the small six-man barrack room [47] or the barrack store [31]. As the 1891 and 1901 census returns record a near identical level of occupancy to the 1881 return, with three families and seven single men (increasing to nine in 1901), the requirement for married quarters must have continued throughout the fort's active life (www.findmypast.co.uk 1891 and www.findmypast.co.uk1901 transcript details for Cliffe Fort, Cliffe at Hoo, Kent accessed 06/01/2011).

Corridor, Coal Store, WC [48]

The corridor has a solid floor in its north-south leg which serves the coal holes and the WC. The solid floor may reflect the service nature of this end of the corridor with the witness mark of a splashback for a large sink set in the north-east corner. The east-west leg of the corridor had a suspended floor, its absence indicated by a marked drop in floor level. This stretch of corridor serves Married Quarters No 1 via a door in the south wall and terminates, at its western end, at the doorway to Married Quarters No 2. The coal stores are placed beneath the hospital stairs with a step down from the corridor floor into the stores. The difference in doorheads for the two stores between a flat sandstone lintel and the usual three course arched head is due to their position in the riser wall. The WC has the usual fitments including a surviving cistern mounted on the east wall on pierced iron brackets. A complete set of shutters and the iron sill are present but to a higher set window than the adjacent rooms and with no splays and a flat sandstone lintel. These two features may be connected with supporting the hospital stair that rises over this room. The provision of shutters and the sill for the window confirm that it was intended as a rifle position, covering the re-entrant angle of the bastion wall. The height of the sill and the small size of the room do suggest that the best firing position would be attained by standing on the WC.

Married No 1 Quarters [49]

Several features suggest that this room was not constructed as married quarters but was created by the construction of brick partition walls within a larger room, possibly intended for sergeants. The stack against the west wall appears to be inserted, or at least extensively rebuilt, the brickwork does not course through in the north-west corner and the overall quality of brickwork in the stack is noticeably poorer than the surrounding walls. The grate is not placed absolutely central in the stack and the usual sandstone slab over the grate which marks the point at which the flues bifucturate, is here replaced by an iron plate, a feature not found in any of the surrounding stacks. The ceiling adjacent to the north wall shows evidence in the form of a sandstone slab for the removal and sealing of a drum air vent. The 1899 plan (TNA: WO78/4963; App Fig 1) shows cupboards either side of the stack on the west wall, conforming to the 1861 requirements for furniture in married quarters. Presumably one of these cupboards accommodated the husband's equipment rather than the open rack associated with the common barrack room. Contrary to the depiction on the 1899 plan the room has a solid floor which may be a straightforward alternative to rebuilding a suspended floor to accommodate new partition walls and a stack. Previous use as a barrack room could be indicated by the brackets for accoutrement racks visible in the north and east walls. They indicate at least two bed spaces in the room, rather than the one bed provided by the 1861 regulations for married quarters (Douet 1998, 145). The smaller number of bed spaces (space being a privilege of rank) would suggest intended occupation by sergeants.

Married No 2 Quarters [50]

The east wall of Married No 2 Quarters is the party wall with Married No 1

Quarters [49] and, like that wall, it exhibits evidence of later construction or extensive rebuilding. The bottom third of the stack is rebuilt with irregular coursed English Bond brickwork with slivers making up the junction with the east wall. There is evidence for an air vent pipe running from the stack to the north-east corner of the room. This intrusive air vent pipe, when all the other stacks have a vent pipe running in the wall thickness, again suggests that the stack and the surrounding wall is inserted. Like Married No 1 Quarters there is no air vent in the ceiling nor is there any evidence for a vent ever having been *in situ*. This suggests that this room may have originally been a store perhaps an adjunct to the sergeant's quarters [49]. It was usual to have a store for equipment adjacent to the Sergeant's room so that its contents remained under his supervision (Douet 1998, 187).

The west wall contains two window openings with the only well-preserved sash window frames in the fort. The joinery and fittings on these frames appear to be typical for the period around 1870 and are of good quality. The south wall of Married No 2 Quarters is an 0.35m (18in) thick brick wall of two leaves. Most of this wall has collapsed revealing irregular bonding in the east corner further suggesting that the partition wall between the two Married Quarters is inserted. On its south side this wall forms the riser wall for the north side of the stairs to the canteen which may explain its double thickness. The collapse of the wall and the stairs has removed the landing and with it the access to the loopholes located between the hospital range and the bar on the first floor.

First Floor

The first floor of the south range is reached via the hospital stair located between the barrack rooms and the Married Quarters [49, 50]. On the first floor the stairs emerge via a quarter turn onto a sandstone slab landing running north-south. At the north end of the landing is the entrance to a passage running east-west along the north side of the range (Fig 35). This had a suspended timber floor carried over the Fox and Barrett ceiling of the barrack rooms below. The removal of this floor and the subsequent collapse of sections of concrete reveals the run of cast-iron piping from ventilators in the ceilings of the barracks. The passage has three regularly-spaced windows all of which

Figure 35: View looking west along the hospital corridor. The Fox and Barratt construction of the barrack room ceilings can be seen through the hole in the corridor floor. (DP 097498)

originally had sash frames, one at the head of the landing the other two opposite the position of ward doorways. Located beneath the western window is the fire escape consisting of iron staples mortared into the wall (Fig 31). Opening off the south side of the passage are three rooms each of a similar size and a much smaller room at the east end. The passage ends at a larger room extending the full width of the first floor.

To the west of the stair the first floor is divided into two roughly equally-sized rooms by a partition wall running north-south. The 1899 plan (TNA: WO78/4963; App Fig 2) identifies the rooms to the east of the landing as the kitchen, two hospital wards, a store and the hospital sergeant's quarters, with the dispensary and WC to the west. Evidence to the 1869 committee (House of Commons 1869, Appx 4) states that all of the forts were to be provided with hospital accommodation; at Cliffe using the first floor to place patients out of the way of the day to day activity of the fort seems to have been a sensible solution to this requirement. The first floor would also provide more fresh air which was considered essential for patients (Douet 1998, 142).

The south wall of the passage, containing the entrances to the wards and hospital kitchen as identified on the 1899 plan (TNA: WO78/4963; App Fig 2), has been removed completely (Fig 35). The plan shows that each room has a single centrally-placed doorway. The walls have been removed in a systematic fashion leaving no evidence of thresholds. Most of the partition walls for the hospital sergeant's room and the store remain but the partition walls between the other rooms have all been dismantled. All the window openings in the south wall – the gorge face – have splayed jambs and the mounting points for iron shutters; set backs in the brickwork remain as evidence for sash frames and their accompanying boxes. The remaining interior walls of all the rooms were whitewashed with no traces of plaster. All the rooms other than the store room have a ventilator in the ceiling.

Hospital Sergeant [30]

This room, living quarters for the sergeant charged with the day-to-day running and administration of the hospital and the supervision of the patients and orderlies, is at the east end of the hospital passage. The room is entered by a door in its west wall, with windows in the north and south walls. An iron pipe for the ventilator in the room below is visible just proud of the Fox and Barrett ceiling surface, suggesting that the sergeant's room had a suspended floor running over the fireproofing. The stack is centrally-placed in the west wall, with L-shaped iron brackets to its south, probably for a water tank. An indication of the domestic nature of this room is provided by iron pins set into the brickwork either side of the window in the south wall: probably supports for a curtain pole.

Store [29]

As is usual for a store, this rectangular room has no stack, no underdrawn ceiling and a solid floor. The window head in the south wall window has been altered, with the lower corners of the head cut back, creating a flat head and making the angle of the splays more oblique. Altering the head and widening the splays would change the field of fire from this window, allowing a blind spot at the corners of the demi-bastion to be covered from here.

Ward [28] and Ward [27]

Both hospital wards are virtually the same: large rectangular plan rooms originally with suspended floors and an underdrawn ceiling. The partition wall between the two rooms has been mostly demolished and the shared stack completely demolished, revealing a ceramic pipe running in the thickness of the wall connecting the grate to a vent in the gorge wall.

Kitchen [26]

The kitchen has lost its east and north walls, leaving only the west wall with the remains of a centrally-placed stack. This stack has a large chimney breast which, at 2.16m, is wider than the examples in the domestic rooms. To the south of the stack is a sandstone slab and the scars from what was probably a slate splashback in the south-west corner. The 1899 plan (TNA: WO78/4963; App Fig 2) shows a sink in this position and the 1891 plan (TNA: WO78/3427) shows that its water supply was held in a large tank mounted above the head of the adjacent stair.

Dispensary [23]

The dispensary, as labelled on the 1899 plan (TNA: WO78/4963; App Fig 2), is on the west side of the hospital stair and has a door in its north-east corner. The nearly square plan room is unheated but has a ventilator in the ceiling. Two rows of timber plugs in the east, south and west walls provide evidence for the shelving shown on the 1899 plan. Part of the west wall has collapsed leaving a hole through to the adjacent canteen store.

Lavatory [24]

To the south of the dispensary and entered by a doorway from the west side of the hospital landing is what is labelled on the 1899 plan (TNA: WO78/4963; App Fig 2) as a lavatory. A circular aperture in the floor close to the south wall marks the position of a toilet bowl and the remains of brackets for a cistern are visible in the wall above, as visible on the 1891 (TNA: WO78/3427) and 1899 plans. In the north-east corner of the room the edges of a slate slab set in the north and east walls can be seen; a sink is depicted in this position on both plans. Marks for timber boxing for plumbing and for a partition that reached a height of 2.3m (7ft), leaving a gap to the ceiling, are visible in the south wall. These marks correspond with the position of a timber partition depicted on the 1899 plan. Two circular ceiling vents are provided either side of this partition line, one in the south-west corner and one in front of the window in the south-east corner. The 1899 plan shows the area to the west of the partition as empty but supports for a Belfast sink are visible in the north wall with the water pipe for the sink running through the wall and into the canteen stair well where its course can no longer be followed due to the collapse of these stairs. In the south-west corner of this room a patch of inserted brickwork indicates the position of a borrowed light shown on the 1899 plan.

Canteen Manager's Store [22]

Though technically in the south range, the Canteen Manager's Store could not be entered from the hospital range. This is symptomatic of the irregular internal division of this area which require borrowed lights to light the stairwell. This appears to be dictated by the requirement to provide a clear area, for riflemen, around the loopholes in the east face wall of the south-west bastion. In turn this dictates the placing of stacks and the stair leading to the canteen.

According to the 1899 plan (TNA: WO78/4963; App Fig 2) the entrance to the Canteen Manager's Store [22] was from the Bar in the east corner of the demi-bastion. The room is rectangular in plan with windows in the north and west walls, the west wall forming the end wall of the south range. The ragged hole in the east wall is probably recent work to make a route into the first floor of the demi-bastion now that the canteen stairs have collapsed. The stack is *in situ* in the centre of this wall but the lower quarter has been robbed out revealing the flues and the absence of the sandstone lintel above the grate. The absence of this lintel and a small rodding box and its cover, set in face of stack (which is the only incidence of this arrangement noted inside the fort) suggest that this stack could be a later addition. However the ventilator present in the south-east corner does not appear to be inserted and its presence suggests that the room has always been for domestic use. This arrangement of ventilator but no stack is evident in the nearby Dispensary [23]. Three columns of timber noggins set at 1.07m centres in the south wall are evidence for shelves as per the 1899 plan.

The 1899 plan (TNA: WO78/4963; App Fig 2) depicts two borrowed lights in the south-east corner of this room. One located to the south of the chimney provided light to the western half of the hospital lavatory, which was isolated from the window by the timber partition shown on 1899 plan, the other in the south wall lit the top of the canteen stairs and the adjacent landing, compensating for the low level of light that would enter the room via the loopholed east wall (Fig 36). The position of the light in the east wall is visible as a patch of repaired brickwork, and the south wall has been demolished leaving a small stub of brickwork at the end of the east wall and a set back for a door jamb and a springing for a door head in the west wall.

Figure 36: Loopholes on the eastern face of the south-eastern demi-bastion as seen from the hospital lavatory. Iron brackets that held downpipes can also be seen. (DP 097504)

South-West Demi-Bastion

This two-storey bastion is present to allow six musketry loopholes at first-floor level in its east facing wall to enfilade the south face wall of the fort (Fig 36). The return of this wall then forms the ragstone-clad south wall of the demi-bastion ending at the corner with the west-facing granite-clad face wall of the battery. Internally the bastion extends only as far as the substantial traverse wall that forms the rear wall of the open battery and the stores [55 to 59] in the basement. On the exterior of the fort this break between the battery and the domestic and service rooms in the demi-bastion is visible in the ragstone as a straight joint, with an increasing outward splay towards its top, between the lengths of wall to the east and west. Like the south-east bastion, the irregular internal shape of this bastion would make it difficult for living accommodation, in particular barrack rooms, to be placed within its internal footprint. Instead the 1899 plan (TNA: WO78/4963; App Figs 1 and 2) shows the ground floor occupied by a wash house and laundry and two store rooms, while the first floor is divided into a Bar, NCOs room, a tap room and store room. The NCOs room may be the replacement for the Sergeants' quarters in the south range that were possibly converted to Married Quarters [49] [50]. The use of 'NCO' rather than 'Sergeants' is contemporary with the 1899 plan as the concept of a non-commissioned rank higher than Sergeant, a Warrant Officer, was only introduced in the late 1890s (Pattison 2002, 154). The tap room probably acted as the separate mess for the NCOs with the soldiers using the bar (Douet 1998, 175). Like the east range, the flues for the fireplaces and stacks on the ground floor rise in the thickness of the gorge wall. As with the south-east bastion, placing the flues in this position avoids obstructing the interior with stacks and fireplaces.

The north-east corner of this bastion is occupied by the canteen stair which, to accommodate six loopholes in the flank wall of the demi-bastion set at first-floor level, makes a 180 degree turn and incorporates two landings, the first-floor landing being wider to provide positions for the troops using the loopholes. The riser walls for this stair, and particularly the south wall, project into the wash house and laundry. To make the best use of space the entrance to this room is beneath the upper flight of the stair in an irregular-shaped lobby, its walls formed by the risers. The entrance from the lobby into the wash house was through a flat-headed archway in the riser wall. To take advantage of space under the canteen stair, a small WC has been built with its entrance in the east wall of the lobby and its roof formed by the sandstone slab of the intermediate landing in the canteen stair. The majority of the stair and its risers have now collapsed, probably due to the robbing of the sandstone treads. The rear wall of the WC is still *in situ* with evidence for a bracket and patches of whitewash. The east jamb of the entrance to the laundry and part of its head also survives.

Wash House and Laundry [52]

The wash house and laundry, as labelled on the 1899 plan (TNA: WO78/4963; App Fig 1) occupy the east end of the demi-bastion. The north wall of the laundry, through which the doorway from the lobby opened, has also collapsed leaving only the section in the north-east corner. This section supports the first floor landing of the canteen stair and beneath it is a single rectangular room, entered from the

laundry via a low doorway with a flat sandstone lintel and set backs for an outward opening door. This room has a low ceiling, a sunken floor and walls covered in a very fine-grained cement-based render. In its north-west corner is a square platform. The 1899 plan does not show a room under the landing, rather two short walls projecting at 90 degrees from the north wall forming two bays. The 1891 plan (TNA: WO78/3427) shows a large water tank in this position, presumably the supply for the laundry. The short walls provided a support for the water tank and the scar for the centrally-placed short wall is still visible, along with a mark for the base of the tank, running across the two bays. It is clear that the tank was removed to allow the piercing of the doorway to use the space under the canteen stair. The function of this space is unclear but it would have been bombproof.

The east wall is blind, presumably as a requirement of the demi-bastion's trace. In its north corner is a vertical set back for a water pipe protruding through the ceiling. The rest of the wall is occupied by a substantial groove cut into two courses of brickwork around the height for a workbench. The 1899 plan (TNA: WO78/4963; App Fig 1) shows a substantial timber bench in this position which would correspond with the deep slot in the brickwork. Below the groove are three iron strap brackets, at 31cm centres, set into the mortar course. Above it are the cut off ends and marks from further iron shelf brackets and at the south end two substantial pierced iron brackets at 56 cm centres which could be mounts for a water tank shown on the 1891 plan (TNA: WO78/3427). The iron strap brackets, water pipe and the large pierced brackets suggest substantial plumbing typical of a laundry.

On the south wall are the footings and the eroded corners of a large, 2.9m long, brick base sitting on the solid floor and located between the two window openings (Fig 37). Set in the wall behind and above this brick base are four or five vents, three

Figure 37: The brick bases for the washing coppers on the south wall of the Wash House and Laundry. (DP097511)

with rectangular cast-iron surrounds embossed with the name 'Wigmores'. Both the vents and the remains of the brick base are full of soot or ash. The size and location of these remains and the correspondence of the smoke vents with the base suggests that these are the remains of the bases for washing coppers and their flues depicted on the 1899 plans (TNA: WO78/4963; App Fig 1) along with a boiler noted on the 1891 plan (TNA: WO78/3427). The 1899 roof plan (App Fig 3) reveals the tops of three flues running in the thickness of the south wall, the eastern most of these immediately above the location of the base and the vents in the wall. To the east of the washing copper bases are three holes in the brickwork, the central one occupied by a squared timber with tenons on the soffit. Similar holes set at 1.26m centres are located in the wall to the west of the copper. The 1899 plan suggests that these holes and the squared timber are the remains of further work benches placed beneath the windows in the south wall. These windows have the usual splay-sided openings and the eastern window retains one shutter and an iron sill.

The north-west corner of this room contains a collection of disturbed brickwork, scars and iron fittings that indicate the removal of a substantial structure as do corresponding vertical scars in the west and east walls, with poor-quality brickwork (Fig 38). They are probably the remains of a large patent hot-air closet for drying clothes often found in military establishments. The remains of an example was found in the Guard Room to the North Entrance of Dover Western Heights (Brown and Williams 2001, 32). These closets consisted of a large stack with a grate and flue at the front, behind which was a separate narrow compartment running the width of the stack. Sliding into this compartment through a slot in the flank of the stack was a large wrought-iron clothes horse supported on rails and flanged wheels. On a similar principle to the Arnott's stoves, a separate hot air flue took hot air from a collecting chamber above the grate at the front and channelled it through the clothes horse compartment and out of another flue to the rear.

Figure 38: Possible remains of hot-air closet in north-western corner of the Wash Room and Laundry. (DP097512)

The top courses of this virtually square 1.9m stack remain supported 2.5m from the floor on a wrought iron grid which has the ends of its constituent beams set in the west and north walls. Springing from the grid is the arched head of what was, presumably, the hot air chamber. This is formed from three layers of red tiles, similar to roofing tiles, thickly mortared together. Set in the centre of the vault is a small earthernware pipe; the 1899 roof plan (TNA: WO78/4963; App Fig 3) suggests that a flying flue at the top of the west wall connected this to the flues in the south wall of the laundry. Above the arch, and not keyed into the laundry walls, are seven courses of stretcher-bond brickwork extending to the soffit of the iron beams in the Fox and Barratt-type roof. The collapse of the brickwork in the south-east corner of the stack reveals that, behind the brickwork, the gap between the top of the arch and the ceiling is filled with concrete similar to that used in the roof. This, along with the use of the same colour bricks, suggests that the stack is contemporary with the laundry walls and ceiling. On the south side of the stack a mortar course at the bottom of the brickwork, and corresponding marks in the brickwork of the laundry wall, suggest that originally this wall descended to the floor forming the south side of the stack.

The wrought-iron grid suggests that the hot air closet at Cliffe was a larger and more elaborate version of the one at Dover, with four clothes drying compartments rather than one. The grid is formed from two sizes of 'L' section ironwork welded together. Five pieces of small 'L' section run east, from neatly made sockets in the header course of the west wall, dividing the space inside the stack into four equally-sized compartments and two narrower compartments. This may indicate the division of the stack into four central drying compartments with, at their north and south ends, smaller heating compartments. The east side of all these compartments is formed by the single piece of large L-section, which runs north-south. It is set in the north wall at the head of a pronounced scar in the brickwork, probably the position of a removed iron jamb, which aligns with the edge of the surviving section of the stack. The now unanchored south end was probably set in the now demolished brickwork forming the south side of the stack. In the bottom web of the L-section are four notches, all of the same depth, set so as to place each one slightly off-centre in each of the four equally-sized compartments. The notches may be evidence for the course of the top rail on which the clothes horses ran. Above the large section 'L' are further pieces of ironwork which appear to be the cut-off ends of a lintel that would have supported the brick-built stack over the opening for the clothes horses in its east face, a similar opening for the grate and flue may have been located in the south face.

Further remains of the closet are suggested by fittings in the west wall immediately to the south of the stack. At the base of the wall is an iron pulley wheel set at the foot of a vertical slot chiselled into brickwork and, like a row of four iron mountings at 0.3m centres chiselled into the brickwork the foot of this wall, running into the corner. Above these, circa 1.5m above current ground level, is a sandstone lintel witness to a blocked opening, visible as a straight joint, beneath the position of the flue at the top of the west wall.

Barrack Stores [53] [54]

The barrack stores are two identical rectangular rooms both with a doorway in the south wall of the passage to the 9-inch RML magazines. Unusually for store rooms both are heated, sharing a centrally-placed stack in the east and west walls

respectively. The fireplace in the west room has been very neatly bricked up which suggests it was closed at an early point in the fort's life. Evidence for the use of the rooms as stores is provided by the remains of iron shelf brackets in the the east and west walls and numerous timber plugs for earlier shelving.

First floor

Stair and Landing [21]

This stair rose from an entrance in the west wall of the demi-bastion, placed between the Married Quarters [50] and the Laundry [52], to the canteen and bars on the first floor. Empty joist pockets in the east wall of the bastion indicate the position of the suspended timber floor of the first floor landing. This landing formed the floor of a passage for the two loopholes in the re-entrant corner of the demi-bastion. The wall forming the south riser to the staircase continues to the ceiling on the first floor. Openings in this wall at its west and east ends allow access between the canteen store and the bar and the passage to the loopholes respectively. Both openings have three course heads with bull-nosed jambs, only the western opening shows evidence for a doorframe.

Bar, NCOs Room, Tap Room [21,20,19]

The Bar shown on the 1899 plan (TNA: WO78/4963; Fig App 2) occupied the irregularly 'L' shaped interior corner of the south-west demi-bastion. Its most noticeable feature are the six loopholes of conventional construction in the east wall. Four of these loopholes are regularly spaced at 1.52m centres, but the two northernmost are at closer centres and have splays at different angles. These two loopholes have been previously mentioned as situated in the passage at the top of the stairs, reached via a doorway in the east wall. All the partition walls between the Bar, NCOs room, Tap Room and Store Room as labelled on the 1899 plan have been demolished (Fig 39), leaving a series of scars in the south wall as witness to the various partition walls. The holes for chimney flues in the roof have been neatly infilled with concrete caps and a similarly neat job of asphalting over the former chimneys has been done on the roof. The neatness of this work and the removal of the partition walls suggests that this was a deliberate reordering rather than the robbing out described previously in the hospital. The west wall of the Tap Room [19] marks the junction between the battery and the gorge buildings. The adjoining room labelled as 'Store Room' on the 1899 plan has no internal connection to the other rooms in the south-west demi-bastion and has been discussed in the context of the 9-inch RML open battery and the artillery store at the end of the parapet referred to in the report and estimate of 1870 (TNA: WO30/107/61; see Chapter 7).