1 A History of Earthworks In the United States

Introduction

Earthen fortifications have played a role throughout American military history. Earthworks of varying size and complexity dot our battlefields and military sites and their identification can be challenging. Time, erosion, weathering, and human disturbances have modified most earthen fortifications to a degree that specialists are required to identify their type and function from what remains. The best way to determine an earthen fortification's function, its original extent or appearance at any given time, is to do research. Finding written accounts, maps, or photographs of a fortification at the time of its construction can go a long way in answering many questions a contemporary manager would ask. From this information, it becomes relatively easy to compare the surviving remnant with what was originally constructed. In many instances, however, historical information is not available and the only recourse is to make an educated guess based upon existing site features.

In the cases where historical documentation is inconclusive, identification of earthworks is first a process of eliminating all possible modern earthen structures from consideration, such as agricultural terraces or landscape berms. Once those possibilities have been discarded, a series of questions can be asked to narrow the field of possibilities. First, one needs to ask at what stage in the design evolution of earthen fortifications do these examples represent and what formal training or influences the military personnel might have had who constructed them? Second, what purpose did these earthen fortifications serve and under what circumstances were they constructed? Third, how would these earthen fortifications have looked, not only at the time of their construction and use, but post-battle, when agriculture resumed or the site was abandoned? In order to answer these questions, it is essential to become familiar with the period literature, both in Europe and America, that shaped military thought and design, as well as to understand the action and personnel of the battle and the post-battle land use changes.

This chapter includes a discussion of the evolution of fortification design as it originated in Europe and was practiced in the colonies and United States up through the Civil War. While it emphasizes the design and use of earthen fieldworks, a discussion of permanent masonry fortifications is required because they evolve from the same design theories. Two basic types of fortifications were erected in the United States during the eighteenth and

nineteenth centuries. One was masonry fortification—a permanent type, usually constructed along the seacoast. The second was earthen fortification—usually built for more temporary reasons and most often constructed in the field of battle. As the technology of war evolved, the methods and styles of waging war changed with the technology. In the case of weaponry design, the introduction of rifled artillery during the Civil War, with its ability to crumble stone and brick, heralded the obsolescence of masonry fortifications. Whereas, earthen fortifications and their ability to absorb the impact of rifled artillery, made them essential features for withstanding an enemies attack. Therefore, as an adaptation of the masonry form, it is extremely important for those attempting to identify features of earthen fortifications to have an understanding of the design principles, teachings, and guidelines used to create masonry fortifications because the references are the same.

FORTIFICATION AND MILITARY THEORY IN EUROPE 1500-1800

The art of fortification was refined by European theorists between the fourteenth and eighteenth centuries. One theorist, a seventeenth-century French engineer—Sebastien le Prestre de Vauban,—standardized a design of fortification based on a series of geometrical shapes and angles allowing fields of fire to cover all approaches to a fort. Vauban's principles revolutionized fortification construction, which in turn dictated new strategies for capturing these forts. A well-trained offensive force, for example, could predict the number of hours needed to capture a Vauban inspired fort by applying the same principles of parallels and zigzags to the attack. At this time, the art of fortification in Europe, and European fortifications in the New World, were centered on large permanent forts protecting cities and strategic locales. In the seventeenth century, earthen fortifications were rarely used, and then only as a last resort for retreating armies in the field.

Two wars during the eighteenth and early nineteenth centuries greatly influenced military thought well into the mid-nineteenth century. These were the Seven Years War (1756-63) and its American counterpart, the French and Indian War (1754-63), the other was the Napoleonic Wars (1803-15). During these conflicts, the primary weapons were the smooth bore musket, which had an effective range of 50 to 75 yards, and smoothbore limited range artillery. The smoothbore technology resulted in tactics that were based on linear, massed, open field formations and movements. These wars, particularly the Seven Years war, were considered the last of the gentleman's wars waged by professional armies .[1]

In Europe at this same time, special schools were being developed to teach military disciplines. Napoleon established the Ecole Polytechnique to train the elite, especially engineers, of the French military. Baron Simon Francois Gay de Vernon, as one of the first professors to teach fortification and the

art of war, published a textbook in 1805 for use in his classes. The book, *A Treatise on the Science of War and Fortification*, became the standard text for instruction in the art of fortification in France through the first quarter of the nineteenth century and was used as the chief source for American military educators as well.

THE EVOLUTION OF AMERICAN EARTHWORK FORTIFICATION THROUGH THE WAR OF 1812

Although Native American populations used various forms of fortification for thousands of years prior to European colonization, the development of military fortifications used in the United States in the eighteenth and nineteenth centuries, was of European origin.[2] European military strategists had studied and refined the art of fortification for several centuries prior to applying its use in American conflicts.

The use of field fortifications followed several lines of development during the course of American military history. Prior to the American Revolution, the use of fortification was relatively primitive. European professional armies operating in the colonies built large permanent fortifications, usually at important seaports, using the most advanced principles available to them. However, it was not common for opposing professional armies to construct field fortifications on a large scale because of the type of open field massed movements, the rigid regulations of the armies, and the sense of duty and propriety professional soldiers extended to each other.

In contrast, frontier defenses constructed by settlers and militia units, consisted of wooden structures such as log blockhouses, fortified homesteads, and palisade log forts which were often supported with earth buttressing. At times, these fortifications were hastily built defenses. At Bushy Run during Pontiac's Rebellion in Pennsylvania, for example, English regulars built fortifications with flour bags from the supply train rather than dig earthworks.

At the beginning of the French and Indian war, George Washington and his force of Virginia Militia became surrounded at Great Meadows, Pennsylvania, and built Fort Necessity. It was not constructed using the principles of fortification as practiced in the eighteenth century, but hastily constructed for survival. The fort consisted of a log palisade built upon an earthen mound surrounding a log cabin, with an encircling ditch in front. Having no time to plan, the fort was poorly situated in a valley where enemy fire made the location untenable, and without much effort, the attacking force compelled Washington to surrender.

Later, during the American Revolution and the War of 1812, earthworks were employed primarily as defenses for garrisoned areas or as positions from which a defense could be maintained against greatly superior numbers. In many cases, earthen field fortifications became the best way to equalize the disparity between the large, well equipped, disciplined English army and

the small, poorly equipped, untrained Colonial army. Surviving examples of Revolutionary War earthen fortifications are the Star Fort at Ninty-Six, South Carolina, and the siege lines at Yorktown, Virginia.

Field fortifications constructed during the Revolution were often based on European design (usually Vauban), and incorporated most of the basic principles of fortification as practiced in Europe. Just as often, however, the earthworks and forts were crude and not as intricate or precise as European standards would propose. Throughout the Revolutionary War, the Americans were thwarted by the lack of trained or experienced leaders to teach the art of war and fortification to their inexperienced militia. Valuable knowledge about military theory and training was brought to America during the Revolution by trained European mercenaries and many of the fortifications were designed and constructed by them or by Americans they trained. Among the most notable examples are the defenses designed by Tadeusz Kosciuszko, a Polish mercenary, at Saratoga, New York, and Charleston, South Carolina, as well as other fortifications for the Continental Army. France's growing involvement in the Revolution brought French military leaders and advisors into the war on the side of the Americans and they passed on the latest principles of fortification to the American commanders. Despite these efforts, American military leaders had more to learn. Following the end of the war in 1781, they went to Europe to study the works of the great European theorists first hand.

The War of 1812 found America without the great influx of European mercenaries the Revolution enjoyed. The art of fortification fell on the shoulders of American officers and earthen field fortifications reflected the varied training and discipline of the volunteers. The best example of this was at New Orleans, where Andrew Jackson commanded a diverse group of citizen volunteer soldiers, which included landed gentry, slaves, tradesmen, Creoles, Indians, and pirates. Their military experience, training, and discipline was equally mixed and the fortifications they constructed reflected this diversity. The defense line consisted of a parapet wall along an existing drainage ditch, with cotton bales, wagons, and whatever else was available, used in its construction. However, Jackson's ragtag force and their makeshift fortifications held, and the beaten English withdrew.

FORTIFICATION AND MILITARY THEORY IN THE UNITED STATES THROUGH THE CIVIL WAR

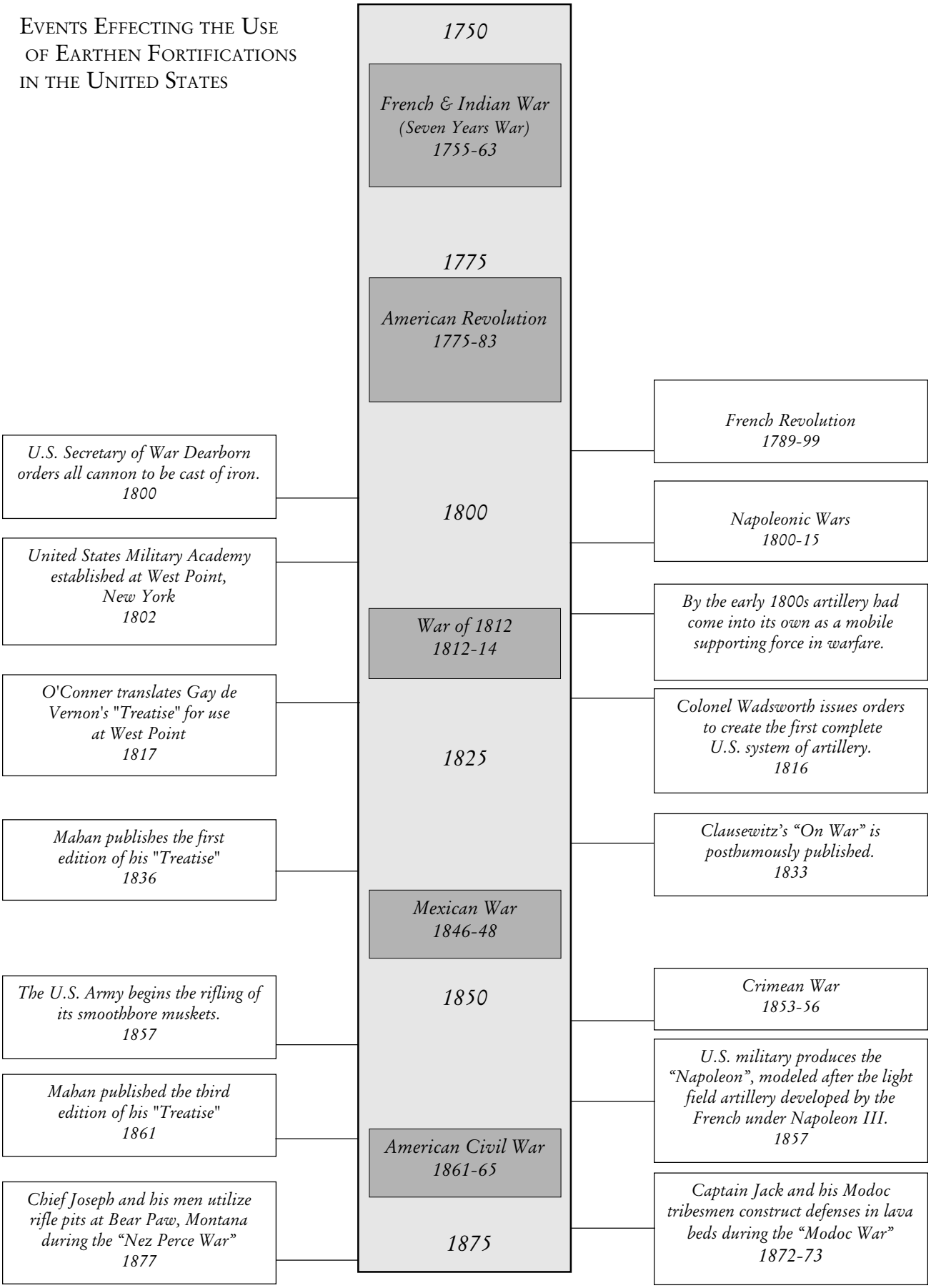
With the English barely beaten, the new nation recognized the need for a formerly trained army and established the United States Military Academy at West Point, New York, 1802. This institution was a copy of the French military school, the Ecole Polytechnique, and its first textbooks were French translations. In 1817, John Michael O'Conner not only translated Gay de Vernon's *Treatise*, but realizing the need to combine strategy, tactics, and

Figure 1.1. This 1864 photograph of federal earthworks near Point of Rocks, Bermua Hundred, Virginia shows the extensive tree clearing which often accompanied large scale earthworks construction.

fortification, O'Conner enhanced Gay de Vernon's book by adding a one hundred page appendix, which was a summary of Jomini's *Traite des Grandes Operations Militaires.*[3] O'Conner's translations remained the standard at West Point for a generation, when in 1836, it was replaced by a new publication by Dennis Hart Mahan.

A graduate of West Point, Dennis Hart Mahan went on to teach engineering from 1824 until 1871 thereby influencing almost every American military leader, West Point graduate or not, who served in the War with Mexico, the Civil War, or the numerous Indian Wars of the nineteenth century, through his teachings and writings.[4] At the beginning of his career, Mahan relied on the standard West Point texts, which for fortifications was O'Conner's translation. Mahan himself became very familiar with the works of Gay de Vernon and of the master engineer Vauban, as well as the newer theories being considered in Europe.[5] As he gained experience, Mahan found the translations inadequate in meeting the needs of the average American soldier

Events Effecting the Use of Earthen Fortifications in the United States



and replaced O'Connor's translation with a series of his own writings. These later evolved into his seminal 1936 publication, *A Complete Treatise on Field Fortification, with the General Outlines of the Principles Regulating the Arrangement, the Attack, and the Defense of Permanent Works*.

Mahan's works advocated the use of field works to provide an edge to the often poorly trained and equipped militias of the United States in the face of more highly trained regulars of European armies. The target audience of *Field Fortification* was the junior officer, West Point trained or not. His book was written, "in a manner to be within the comprehension of any person of ordinary intelligence."[6] The art of field fortification was spelled out in specific detail so that a novice could pick up the book and, if literate, design and build an earthwork that would suit his needs.

The first edition contained eleven chapters dealing with the basic elements of fortification in the field. Prior to the Civil War, two more editions of *Field Fortification* were published. A third edition published in 1861, included a new introduction and three new chapters: permanent fortifications, military bridging, and military reconnaissance. The introduction, which described the effects of musket fire, rifle fire, and artillery, ironically foretold lessons that four long years of bloody conflict made common knowledge; modern weapons were changing the face of war.[7] With the introduction of rifled artillery, soldiers required the protection of earthen field fortifications in order to survive.

By the mid-1840s and the war with Mexico, West Point—through the work of Dennis Hart Mahan—influenced the use of field fortifications. Years of study, in addition to three periods of seacoast masonry fortification development, gave American officers a better foundation in the application of basic fortification principles. Field fortifications used during the Mexican War (1846-48) were based on the same theories and designs that prevailed during preceding periods, but because American forces were on the offensive most of the time, the use of field fortifications had minimal effect.

At the outbreak of the American Civil War, most regular officers of the United States Army had studied Mahan's *Field Fortification*. Officers who had not attended West Point, quickly became familiar with it because of the necessity of applying its teachings. Although there were other published works that contained some information on field fortification, Mahan's book was considered the best.[8]

The use of earthen field fortifications reached a zenith during the American Civil War. As Mahan foreshadowed, the use of rifled weapons changed the face of war forever. Field fortifications, in one form or another, were utilized by both sides during most operations from the outset of the war. In April 1862, when rifled artillery attack left Fort Pulaski in ruins, the armies had proof that masonry fortification could not withstand the new weaponry.

Earthen fortifications, by absorbing the rifled artillery fire, stood a much better chance of withstanding an attack by rifled guns. Therefore by 1864, every movement and every position of both the northern and southern armies, were usually covered by field fortifications. In addition, earthen fortifications were used to protect cities, supply depots, railroad bridges, and to cover roads and river access. The remnants of one of the largest earthen fortifications built during the Civil War is Fortress Rosecrans at Murfreesboro, Tennessee.

Mahan continually revised and released editions of *Field Fortification* after the Civil War, making changes as needed to keep abreast of the latest technological advances. Throughout the rest of the nineteenth century, Mahan's *Field Fortification* stood as the principle reference on fieldwork construction.

In addition to the Mexican War and the Civil War, American soldiers were involved in a series of conflicts throughout the nineteenth century in their efforts to push Native Americans from land coveted by white settlers. Basic forms of fortifications were used by the soldiers, but the art of fortification employed against Native Americans, never reached the level of sophistication used during the Civil War. However, simple rifle pits, battery positions, and breastworks construction were common. Native American's also made use of simple fortifications and defenses of convenience. Noteworthy are the lava bed defenses of Captain Jack and his Modoc tribesmen in northern California, and the rifle pits of the Chief Joseph's Nez Perce at Bear Paw, Montana.

THE CONSTRUCTION OF EARTHWORKS

The construction of earthworks remained consistent throughout their history. The basic technique involved piling dirt, excavated from a ditch, against a revetment, which was made from available wood or stone. As a general rule, earthworks constructed by trained soldiers almost always conformed to the principles of construction as dictated by the various manuals in use at the time. However, several interrelated factors effected the form and appearance of fortifications. These included the expected duration of use, the training of those constructing the works, the conditions under which they were constructed, and their position in the landscape and the relation to other earthworks.

By the mid-nineteenth century, earthworks were generally categorized as either hasty entrenchments or provisional fortifications, depending on their use. Earthworks constructed in the field for immediate, short-term use during tactical combat situations were referred to as hasty entrenchments because they could be constructed in a day or overnight. Because of their "hasty" construction, it is sometimes difficult to ascertain from which manual, or from whose imagination the forms derived. The raw dirt slopes and limited

design of hasty entrenchments were often improved when soldiers occupied the position for several days or more. When this occurred, positions were formalized and earthworks often gained a more "text book" appearance.

More permanent fortifications, both masonry and earthen, were referred to as provisional. In these cases, it was not uncommon for the slopes of earthen fortifications to have sod laid on them to prevent erosion and make the earthworks easier to maintain. As the use of rifled artillery increased during the Civil War, more substantial earthen fortifications were built to counter the impact of the new weaponry. Built to replace the now obsolete masonry fortifications type, provisional earthen fortifications were expected to last the duration of the war or for an extended occupation of a particular place.

A third type of fortification was constructed under specific field conditions where pre-battle landscape features existed such as stone walls, railroad embankments, or felled trees. In these cases, earthworks could be built to reinforce the man-made or natural feature in order to establish a defensive position. The sunken roads at Antietam and Shiloh battlefields are good examples of this fortification type.

Under ideal conditions, an engineer officer directed the construction of earthworks. After selecting and surveying a site, an engineer officer would mark out the positions for specific fortification features. Groups of soldiers, sometimes specially trained for this type of construction, or conscripted laborers would then carefully fill in the well marked areas with excavated dirt. The effort described here was usually associated with provisional works or those earthworks far enough from the front lines that laborers were not under direct enemy fire. The availability of an engineer officer had a marked effect on the quality of fieldworks construction. Although few officers were classified as trained engineer officers, many had some training, if not at West Point, then at another military academy. Many had a basic understanding of what to do when constructing earthworks and had access to a fortification manual such as Mahan's *Field Fortification.* Every soldier who saw action understood the basic principle of a protective shield between himself and the enemy. On many battlefields, enemy fire, poor conditions, as well as the lack of engineer officers and digging implements, hampered the construction of fortifications. Where picks, shovels, and well marked lines were unavailable luxuries, the design and construction of fieldworks fell upon the individual soldiers and the non-commissioned officers to achieve. Each man dug the best he could with what he had—a canteen, bayonet, cup, or his hands.

The first priority in the construction of earthworks was to choose a defensible position. The success of a fortification often depended on the ground it occupied. High ground was preferable to low. The military crest—the line on a hill or ridge just below the summit—provided better protection than the hilltop. Here a soldier was not exposed against the sky. Fortifications

built on the opposite crest of the hill would have their field of fire obstructed, preventing accurate defensive coverage. A defensive fortification positioned poorly was perceived to be a weak point and became a target for assault.

Once a defensive position was selected, the next priority was the location of the ditch. The primary purpose of the ditch was to provide dirt for the fieldwork. The most basic construction of an earthwork consisted of dirt from the ditch being thrown into a pile called a parapet. The parapet wall was usually supported by a wall of hard material called a revetment. The revetment gave support to the earth and added protection from projectiles penetrating the earth. The revetment was usually made from wood, but stone, brick, or sandbags were also used. Wood used in revetment included logs, board, small saplings or twigs woven into a gabion, or small saplings bundled into a facine. Three techniques of construction were used: ditch in front, ditch in rear, and ditch on both sides.

The simplest and most common method of construction was to line soldiers up along the intended course of the work and for them to dig with shovels and picks. If the earthworks was constructed while under fire, the soldiers utilized a back ditch approach, throwing the excavated earth to their front to provide a barrier of earth between themselves and the enemy. Earth was thrown onto existing piles of logs or fence rails to act as a revetment by increasing the bulk of the parapet and its thereby its ability to absorb bullets. When time and need permitted, the trench would be deepened, and the back side of the parapet revetted or reinforced with logs, braided branches, or sandbags. Soldiers often added head logs—logs spaced lengthwise along the top of the parapet—from beneath which the soldiers could fire. This type of field fortification, commonly known as a rifle trench or rifle pit provided basic shelter for infantrymen. The size of this type of earthworks averaged four to five feet in relief. Ditch in rear construction was employed when the slope of the ground did not allow for the construction of a front ditch. In this case a back ditch provided added protection by the creating a low place for cover.

The second technique used to construct field fortifications was to excavate a ditch in front of the parapet. The soldiers first constructed a revetment, then lined up in front of it and dug a trench, piling the dirt against a revetment. Front ditches were generally prescribed to be 8' - 12' wide and 4' - 6' deep. The extra earth made the parapet correspondingly thicker and stronger. A front ditch was desirable because it added another obstacle for attacking enemy troops to overcome. As an assaulting enemy entered the ditch, the added height of the parapet slope made the final push even more difficult. Such works typically were used in semi-permanent fortifications, to shelter artillery batteries, or to provide extra protection for infantry from incoming

enemy artillery fire. Detached works, such as redans, lunettes, and redoubts, were built this way, often under the direct supervision of a military engineer. Long, straight segments of ditch-in-front entrenchments connecting artillery strong points were called "parallels."

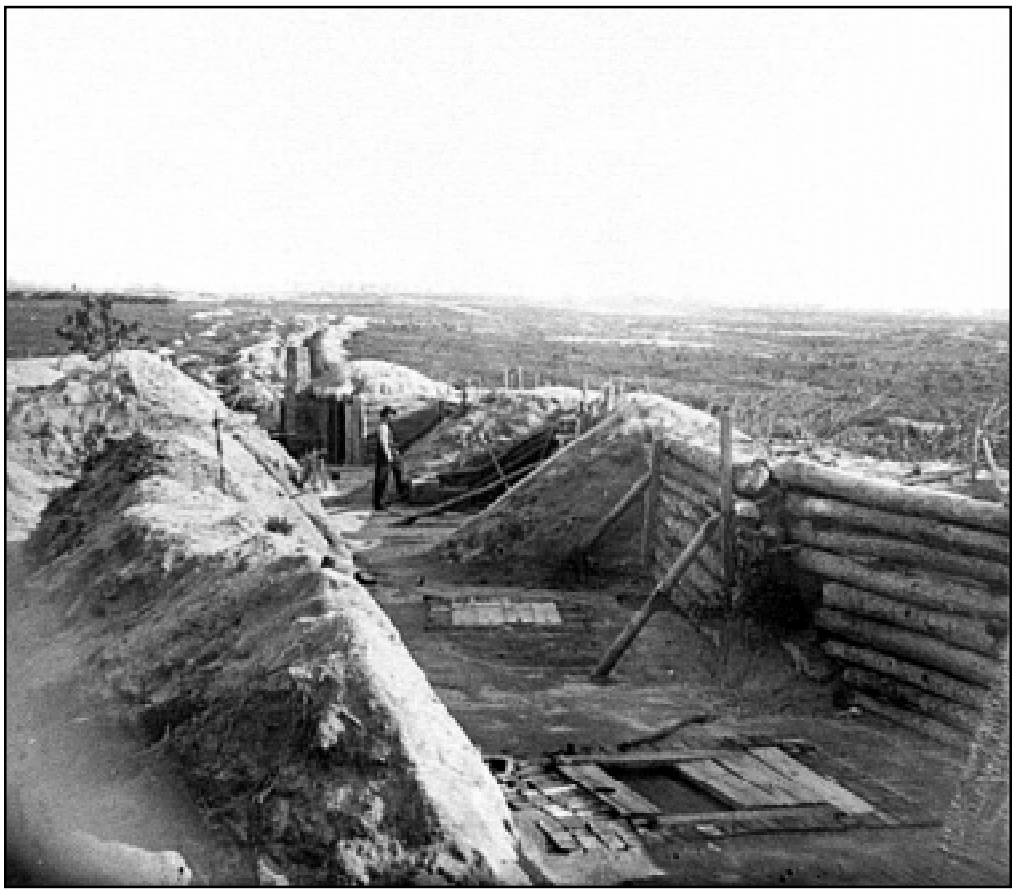


Figure 1.4. This photograph taken in 1865 shows an example of ditch-in-rear construction, using a log revetment, along a federal line near Fort Morton, Petersburg, Virginia.

The third type of entrenchment was built with a ditch on both sides of the parapet. Ditch-on-both-sides construction was often employed as an ad hoc measure to strengthen a section of parapet, to adapt to shallow topsoil, or to respond to uneven terrain. This technique was sometimes used to deepen a wagon road or protect a covered way that ran behind the parapet. Ditch-on-both-sides also occurred when trench segments were captured and refaced or "turned" to face the opposite direction. It is possible to see all three forms of ditches in an area or even in a single line.[9]

In order to facilitate firing at the enemy, several features were added to the basic ditch and parapet fortification. A firing step, also called a banquette, allowed soldiers to step up to the revetment and fire over a high parapet wall. Sometimes the construction of the earthworks, also known as breastworks, only allowed for the height of the parapet to cover a portion of a man standing behind it roughly breast high (five feet). No banquette was needed and defenders would often kneel to fire over them. The most elaborate fortifications had the parapet wall and banquette on a platform called a rampart. Most of the time ramparts were not included in field fortifications, but many provisional and more elaborate field fortifications did include this feature.

Like the banquette, which allowed riflemen to fire over the parapet, gun platforms were constructed to provide stability and maneuverability for artillery pieces. The gun could fire over the parapet in one of two ways. The most common is the embrasure. An embrasure was a slit in the parapet, usually protected by log, plank, or gabion revetment, though which guns could fire. The gun and crew were protected by the parapet wall and only exposed through the slim cut of the embrasure. Often, a gun platform would have two or more embrasures to service one gun. This allowed for an increased angle of fire for each gun, while minimizing exposure of the soldiers. "En barbette" positions placed the gun platform so that the barrel of the gun was above the crest of the parapet and, therefore, able to fire from any point along the parapet wall where a gun platform allowed it.

In front of the main line of fortifications were a series of advanced works. These works included ditches, parapets, covered ways, and rifle pits. Such fortifications provided protection to pickets—a detached body of soldiers serving to guard the army from surprise—while on duty in the exposed front areas of the position. In appearance they were very similar to the main line but built on a much smaller scale.

Examples of these distinct earthworks features can be seen, in various conditions, at National Park Service battlefields. Questions concerning the identification of earthworks in private or public ownership, can be directed to the National Park Service.

Existing Conditions

Identifying the historic functions of existing earthworks can be a challenging task for even the most experienced military historian. Most earthworks are only a fraction of their historic height and width. The following series of figures will help to illustrate how various earthwork structures appear today and will name the various parts where possible. The photographs were taken between 1995 and 1998.

Note: This section is currently being developed by Paul Hawke, Historian at Shiloh NMP. When completed, it will identify structural parts of earthworks as they appear today.

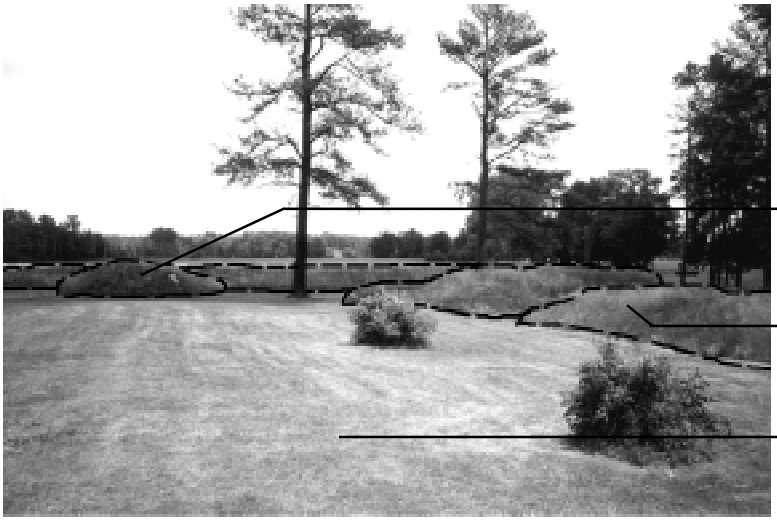


Figure 1.5. Fort Wadsworh at Petersburg National Battlefield

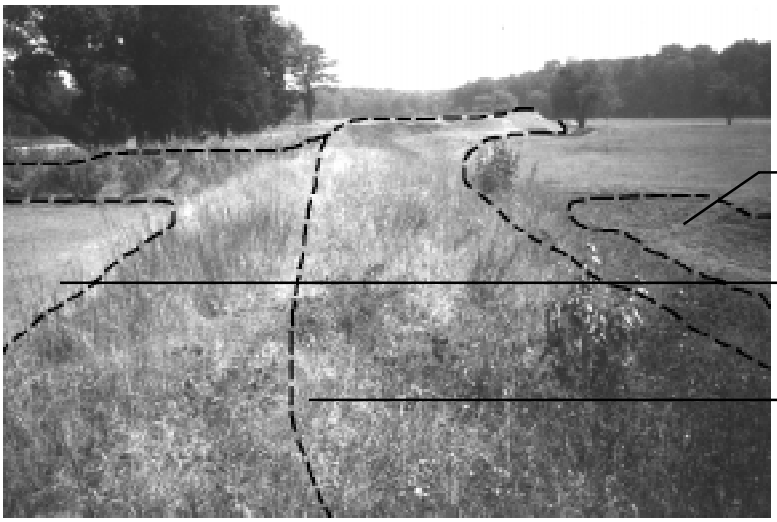


Figure 1.6. Colonial NMP before the August mowing

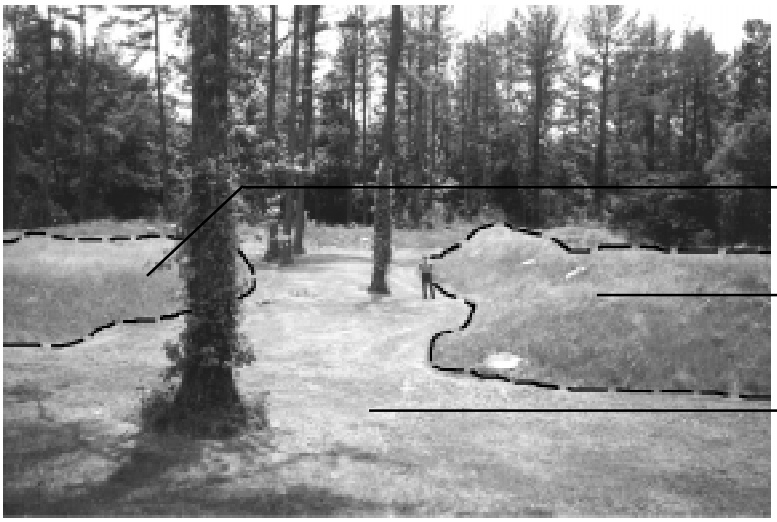


Figure 1.7. Fort Wadsworth at Petersburg National Battlefield

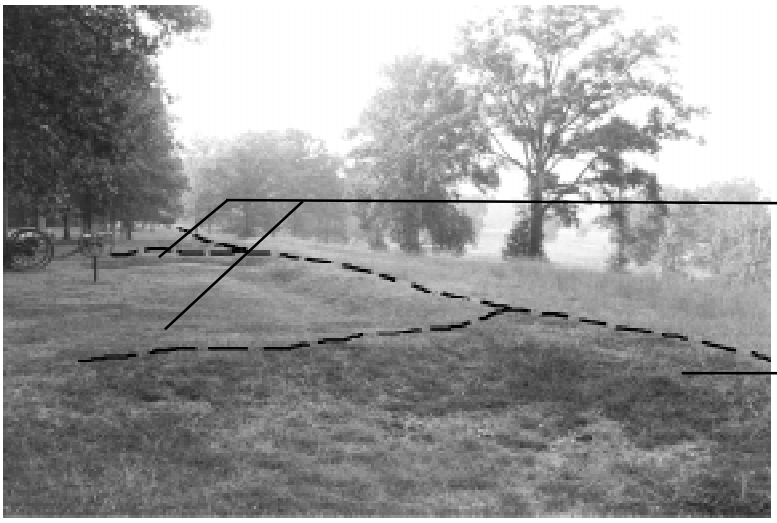


Figure 1.8. Prospect Hill at Fredericksburg National Military Park

Figure 1.9. Battery #5 at Petersburg National Battlefield

Notes on Chapter One

1 The French army in the Napoleonic Wars are usually credited with being the first nationalistic "volunteer" army.

2 Although the finer details of military thought are not evident, many of the principles used in the construction of ancient American fortifications are the same. These ancient fortifications are still historic structures, with historic features, and should be treated just as delicately as a Civil War or Revolutionary War earthwork; possibly even more delicately since they are literally thousands of years old. Many of these fortifications of ancient America are still evident.

3 The role of military theorists Jomini and Loyd in the development of American Nineteenth Century military thought has been discussed among intellectual military historians for years. There are several books and many articles relating to the influence of these two theorists, particularly on the American Civil War. A third theorist, Karl von Clausewitz, has also been added to the mix. Particularly since his view embodied the realistic assessment of the nature of war and the impact of technology as it was being fought in the early to mid-Nineteenth Centuries.

Jomini, served as a staff officer with Napoleon late in the Wars for Empire. It is said that he was so appalled by the savagery and horror of the conflict he witnessed that his writings tried to influence military doctrine to return back to a time of more gentlemanly conflict, that of Frederick the Great. His works served as the bases of many texts and lectures in military science in Europe and the United States during the early Nineteenth Century. Several of his early writings were direct plagiarisms from the English biographer of Frederick the Great, Henri Loyd (especially Loyd's 1790 work *The History of the Late War in Germany: Between the King of Prussia and the Empress of Germany and Her Allies*).

The German, Karl Von Clausewitz, on the other hand, saw the beginnings of total war being waged for political objectives. His work, *On War*, was not popular in Europe until the 1870's. It seems that a war weary, shell-shocked (or post traumatic stress syndromed) continent shared Jomini's desires. However, this does not mean that Clausewitz did not have students of his ideas in the United States. Henry W. Halleck's *Element's of Military Art and Science*, published in 1846, gives reference to Clausewitz. It is not implausible that Mahan reviewed Clausewitz's work, or discussed it with his peers or students, with a view of applying the German's principles to American needs.

4 Of Confederate Generals who attended West Point only Robert E. Lee, Joseph E. Johnston (Class of 1829), and Albert Sydney Johnston (Class of 1826) did not attend classes when Mahan was head of the Engineering Department. Jefferson Davis, President of the Confederacy (Class of 1828) also missed out on Mahan's influence as a department head. However, it is safe to assume Mahan still would have had an influence on these Generals through association and professional development during their careers in the Regular Army.

5 Between 1825 and 1830, Mahan took a leave of absence from his teachings to study fortifications, military engineering, bridging, and public works in Europe. He attended the French school of Application for Artillery and Engineering at Metz. The Metz school was the post graduate course for the graduates of the Ecole Polytechnique who were in line for positions as Engineers or the artillery. Mahan's teachings and writings were based on his studies as a cadet and the four years he spent in Europe. At the Metz school he took copious notes. It was from these notes that many of his lectures were derived.

6 Dennis Hart Mahan, *A Treatise on Field Fortification, Containing Instructions on the Methods of Laying Out, Constructing, Defending, and Attacking Intrenchments, with the General Outlines also of the Arrangement, the Attack and Defense of Permanent Fortifications*, (New York: John Wiley, 1861), p. v

7 Information for this introduction was derived from experiments conducted in Europe on some of the new weapons being produced. Mahan included rates of fire, range, and accuracy for each weapon.

8 During the Crimean War several officers went to observe the conflict. Richard Delafield examined the fortifications of the Crimea and submitted a report to the Secretary of War. It provided a view of how fortification was accomplished in Europe during the 1850's. But it still was not the how-to *Field Fortification*.