



**Historic Structures Report
The Hudson River Defenses
at
Fortress West Point, 1778-1783**

**Douglas R. Cubbison
Directorate of Housing and Public Works
U.S. Military Academy
West Point, New York**

**GIS Analysis by
Kris Brown and Matthew Fletcher
DHPW, U.S. Military Academy, West Point, New York**

January 2005



Historic Structures Report The Hudson River Defenses at Fortress West Point, 1778-1783 Contents

- 1.0 Introduction**
 - 1.1 Study Objectives**
 - 1.2 Historic Introduction**
- 2.0 Background to Revolutionary War River Defenses**
 - 2.1 Contemporary Engineering and Military Manuals**
 - 2.2 Use of River Defensive Chains in Antiquity**
 - 2.3 Historic Experience in North America – Seven Years War**
 - 2.4 Historic Experience- North America- American War for Independence 1776-1777**
 - 2.5 Revolutionary War Artillery Batteries- Design Specifications**
- 3.0 Fortress West Point**
 - 3.1 Fortress West Point– Critical River Defense Batteries**
 - 3.2 Fortress West Point- Other Batteries**
 - 3.3 Fortress West Point - Overall Defensive Configuration**
- 4.0 Conclusions**

Acknowledgements

Bibliography

- Contemporary Military Manuals**
- Primary Sources**
- Secondary Sources**

Appendix A Photographs of Chain Battery Collapse, September 2004

Appendix B Photographs of Redoubt Wyllis Detached Battery

Separate Illustrations

GIS Figure 1	River Batteries Fields of Fire
GIS Figure 2	River Batteries Fields of Fire (3-D Modeling)
GIS Figure 3	River Batteries Field of Fire (Firing Elevations)
GIS Figure 4	Redoubt 3
GIS Figure 5	Redoubt 3 Fields of Fire
GIS Figure 6	Redoubt 3 and Vicinity
GIS Figure 7	Artillery Battery Fields of Fire

Integrated Illustrations

Great Chain across Galley Creek, Malta, Under Attack

Great Chain across Galley Creek, Malta

1759 Log Boom at Fort Ticonderoga

1760 British Engineer Walker Map of Log Booms at Isle-Aux-Noix

Log Booms, “Fortifications at Isle-Aux-Noix in 1760”

Thomas Jefferys, Royal Navy, “An Authentic Plan of the River St. Lawrence (1759)

Map of Quebec and Environs during the Siege of Quebec, Which Fell to the British in September, 1759

Siege of Quebec, 1759

Conceptual Drawing of Log Boom, Fort Ticonderoga 1776

Artillery Platform Design from Rudyard, *Course of Artillery* (1793)

Illustration to accompany Artillery Battery description, LeBlond, *A Treatise on Artillery*

Interior of Artillery Battery From Louis-Nicolas Van Blarenberghe’s painting “The Siege of Yorktown” (1786)

Redoubts from Louis-Nicolas Van Blarenberghe’s paintings “The Siege of Yorktown” and “The Taking of Yorktown” (1786)

West Point and Constitution Island, Operations in America 1780

Barrel Hoop, Twisted into Crude Hook, Recovered from Redoubt 3 during Pedestrian Survey

Integrated Table

Capabilities of British Artillery during War of American Independence



Historic Structures Report The Hudson River Defenses at Fortress West Point, 1778-1783

1.0 Introduction

1.1 Study Objectives

Among the most romantic and historic legends of West Point, New York is the story of the massive iron chain manufactured during the War for American Independence and stretched across the breadth of the Hudson River to preclude a British advance up the river. Although the chain has been the subject of numerous and well-researched studies, the historic background of the chain has not been previously evaluated. In particular, the prior military use of such chains has not been adequately assessed, nor has the role of such chain in 18th century art and science been assessed.

Current U.S. Army doctrine states that no obstacle is effective unless it is placed under observation and controlled by fire, and the West Point Revolutionary War chain was no exception. The presence of river batteries surrounding the chain was every bit as militarily important as the chain itself. Again, the design, construction, and placement of these river batteries have not received comprehensive evaluation. With the recent acquisition of Geographic Information System (GIS) capabilities at the U.S. Military Academy Directorate of Housing & Public Works, the opportunity exists for a re-appraisal of the West Point river batteries.

Finally, the overall defensive configuration necessary to protect the West Point river defenses from British military attack requires review. Faulty American defensive scenarios had doomed the Fort Ticonderoga position in July 1777; and the Fort Montgomery and Fort Clinton position astride Popolopen Creek just south of West Point in October 1777. The West Point position was specifically organized to preclude such an eventuality from occurring there. Again, the new GIS capabilities provide an effective tool for a re-evaluation of the West Point defensive position.

It should be noted that this study is intended to be a companion piece to the *Historic Structures Report on the Redoubts of West Point*, previously prepared by the author.¹

¹ Douglas R. Cubbison, *Historic Structures Report, The Redoubts of West Point* (West Point, New York: Directorate of Housing and Public Works, U.S. Military Academy, January 2004).

1.2 Historic Introduction

Upon the April 1775 commencement of hostilities between thirteen of the fourteen North American Colonies of Great Britain, and Great Britain itself, the Hudson River became arguably the most important river in the Northern Hemisphere. The Hudson River was navigable from the port of New York, one of the largest and best equipped ports in the colonies, to north of Albany. With the exception of a brief portage north from Fort Edward, the Hudson River provided river communications from New York City up the Lake George-Lake Champlain- St. Lawrence River corridor to Canada, Quebec, and the Atlantic Ocean. The Hudson River corridor provided a British naval or army force moving north from New York with an easily traversable route into the heartland of the Colony of New York. Any British force that controlled the Hudson River could also interdict communications and logistics between the New England Colonies of Massachusetts, New Hampshire, Connecticut and Rhode Island which were generally viewed as the radical leaders of the rebellion movement, and the other colonies to the south. Accordingly, defense of the Hudson River corridor became an important strategic concern of the rebellious colonies.

West Point occupied a prominent militarily significant location astride the Hudson River. Here, the Hudson River makes two ninety degree turns, first to the west at “Martelaer’s Rock,” and then again to the north to pass through the constriction between Butter Mountain and Breakneck Ridge.² The constriction of the promontories of Butter Mountain and Breakneck Ridge causes a “funneling” effect of winds from the north. The currents resulting from the two turns, the turns themselves, the funneled north winds, and the results of winds interacting with the adjacent hills and mountains results in difficult sailing conditions for 18th century ships. Sail-driven boats must slow and make numerous changes of tack to negotiate these turns, a job exacerbated by the shifting winds in the narrow river gorge, rendering them vulnerable to gunfire from shore batteries. The location at West Point is protected by the convoluted terrain of the Hudson Highlands, which constrains military operations from the south, particularly since few roads traversed the Hudson Highlands in 1775. The location of Constitution Island in conjunction with the river bluffs at West Point also provides effective firing locations for river batteries on both the east and west banks of the river. The Hudson River is also particularly narrow at West Point, which enhanced the effectiveness of artillery fire across the river. In fact, the peculiar combination of factors that made West Point so attractive a military position is found at no other location on the Hudson River.

In early September 1775 a self-styled military engineer named Bernard Romans arrived at Martelaer’s Rock to supervise construction of “Fort Constitution” on the island.³ Work progressed slowly, obstructed by chronic shortages of money, men and materials; poor engineering work on Romans’ part; and jurisdictional arguments between various revolutionary leaders. Without defenses on West Point, the Constitution Island position by itself was also vulnerable to being rendered untenable by British artillery on this high ground. For these reasons the Americans transferred the major defensive effort in the Hudson Highlands from Fort Constitution to Fort Montgomery, located on the west bank of the Hudson River immediately north of Popolopen Creek, where Anthony’s Nose constrains the river. Work began at Fort Montgomery in March 1776. It soon became obvious that the site of Fort Montgomery was commanded by high ground immediately to the south, across Popolopen Creek. Fort Clinton was therefore constructed on this site beginning in August 1776. The American defensive position contained a number of fatal flaws, one of which was that both forts were served by a single powder magazine located at Fort Montgomery, and that the sole line of communications between the two forts (the pontoon bridge across Popolopen Creek) was not protected by fortifications. In early October 1777 British General Henry Clinton led an expedition north from New York City, ostensibly to link up with another British army under the command

² A range of hypothesis have been expressed regarding the meaning of the name “Martelaer’s Rock,” none of which have been conclusively proven. Various spellings of the name are also noted in different documents. “Martelaer’s” appears to be the most common, and will be used in this report. Butter Mountain, so-called because of the distinctive butter-colored rocks atop the mountain, is now known as Storm King Mountain.

³ Following the completion of Fort Constitution, the island was alternately known as “Constitution Island” or “Martelaer’s Rock” until the early 20th Century, when “Constitution Island” became the generally accepted name. For consistency, this report will use the more common “Constitution Island” for all discussions of the island after construction of Fort Constitution in 1775.

of General John Burgoyne moving south for Albany. Although occupying a well-considered position that was superior to Constitution Island by itself, the fortifications at both Fort Montgomery and Fort Clinton were far too extensive. When actually attacked by the British, the available American force was only one tenth of the force necessary to adequately defend the two forts. Fort Clinton fell in part when ammunition ran out after the Popolopen Creek pontoon bridge was interdicted by British forces.⁴ Fort Montgomery was eventually over-run by superior numbers. With Fort Montgomery and Clinton captured, the British advance continued. On the evening of October 7, 1777 the small American garrison on Constitution Island was approached by a British party, the vanguard of Clinton's force. The Americans fired a single shot at the British and then abandoned the island, burning their barracks but leaving numerous military stores intact, and failing to "spike" (disable) the cannon on the island. British commander Henry Clinton would report of this less than inspired defense:

We sent a joint Summons to Fort Constitution, but our Flag meeting with an insolent Reception unknown in any War, we determined to chastise & therefore an Embarkation under Major General Tryon, and Sir James Wallace with the Gallies was ordered. They found the Fort evacuated in the greatest Confusion, the Store Houses burnt, but their Cannon were left unspiked.⁵

Clinton's command occupied the island on October 8th and demolished whatever remained of military value before it departed.⁶

Following Clinton's withdrawal to New York later that month, American military forces re-occupied Constitution Island. On January 27, 1778 American forces crossed from Constitution Island to West Point. Elements of the U.S. Army have continuously occupied West Point from that date.⁷ Under the able direction of Continental Army Engineer Thaddeus Kosciuszko, an experienced Polish soldier and a classically trained French Military Engineer, the West Point Fortress was established to prohibit English forces from again moving north from New York up the Hudson River.

The first component of the American river defenses at West Point was to obstruct naval movement up (north) on the Hudson River corridor. Because of the presence of the Hudson Highlands with its limited roads and towering mountains, any British advance would be logistically and operationally tied to the Hudson River. The Americans had earlier attempted to close rivers with a variety of techniques, including sunken ships and huge sunken chevaux-de-frix. The chevaux-de-frix were essentially giant marine versions of the smaller land chevaux-de-frix, portable obstructions constructed of a long piece of timber pierced by a number of perpendicular sharpened stakes and used to close openings in fortifications. In 1776 the Americans had used sunken ships and chevaux-de-frix to attempt to obstruct the Hudson River between Fort Washington (on the east or New York bank of the river) and Fort Lee (on the west or New Jersey bank of the river). The depth, tides, and currents of the river combined to render these defenses impotent. The British navy easily bypassed them in August and October 1776.⁸ Chevaux-de-frix was also emplaced in the Hudson River at Popolop Island and Cornwall Harbor north of West Point. Unlike the river defenses at Fort

⁴ Dave R. Palmer, *The River and the Rock* (New York: Greenwood Publishing Corporation, 1969), 113-114.

⁵ "Reports from Sir Henry Clinton's Raid up the Hudson River, October 1777" accessed on-line at <http://revwar75.com/battles/primarydocs/Britishreports.htm> on December 23, 2004.

⁶ For the history of Fort Constitution, refer to Lincoln Diamant, *Bernard Romans, Forgotten Patriot of the American Revolution* (Harrison, New York: Harbor Hill Books, 1985), 69-121; Merle G. Sheffield, *The Fort That Never Was, A Discussion of the Revolutionary War Fortifications Built on Constitution Island, 1775-1783* (West Point, New York: Constitution Island Association, 1969); and Charles E. Miller, Jr., Donald V. Lockey and Joseph Visconti, Jr., *Highland Fortress, The Fortification of West Point During the American Revolution, 1775-1783* (West Point, New York: Department of History, U.S. Military Academy, 1979).

⁷ Miller, et. al, *Highland Fortress*, 62-63.

⁸ Richard J. Koke, "The Struggle for the Hudson: The British Naval Expedition Under Captain Hyde Parker and Captain James Wallace, July 12-August 18 1776" *The New York Historical Society Quarterly* XL, No. 2 (April 1956), 115-174; Richard J. Koke, "Forcing the Hudson River Passage, October 9, 1776" *The New York Historical Society Quarterly* XXXVI, No. 4 (October 1952), 458-466; and William P. Deary, "Defending the Hudson River, 1776-1777: Defending the Lower Hudson in 1776" *Sea History* No. 98 (Autumn 2001), 7-10.

Washington and Fort Lee, these obstructions were not defended by shore batteries, although it is possible that one battery was planned for Plum Point on the western shore but was never constructed. Primarily because of the absence of defending artillery, but also because of the depth of the channel, tides and currents these defenses had also proven ineffective, and Clinton had easily penetrated them in his advance beyond Fort Constitution in October 1777.⁹

In the Delaware River, where the river depth, currents and tides are not as severe as they are in the Hudson River, naval chevaux-de-fris had proven extremely effective. When combined with well positioned, well-fought artillery batteries on both sides of the Delaware River, these river defenses had successfully closed the river for an extensive period of time against determined, well-supported British efforts to seize control of the river.¹⁰

The sunken ships had not proven to be viable defenses, but the chevaux-de-fris had proven that when combined with an integrated defensive strategy that they could effectively obstruct a river. However, the Hudson River is at its greatest depth at West Point, reaching 200 feet at Constitution Island. Additionally, the twin bends and narrow channel at West Point also cause rapid and shifting currents. For these reasons, obstructions that rested on the river bottom could not be placed astride the Hudson River at West Point. The American resolution to this challenge was to adapt a classic technique based upon both previous military experience and advice offered by existing military treatises of the period. That is, the American initiated the installation of a chain and log boom, defended by artillery batteries on either shore, across the Hudson River.

⁹ Lincoln Diamant, *Chaining the Hudson, The Fight for the River in the American Revolution* (New York: Lyle Stuart Book, 1989), 36-37, 123-132.

¹⁰ DuCoudray, "Du Coudray's Observations on the Forts Intended for the Defense of the Two Passages of the River Delaware, July 1777" *Pennsylvania Magazine of History and Biography* XXIV, No. 3 (1900), 343-347; Hugh M. Brackendridge, "The Siege of Fort Mifflin" *Pennsylvania Magazine of History and Biography* XI, No. 1 (1887), 82-88; Samuel S. Smith, *Fight for the Delaware, 1777* (Monmouth Beach, New Jersey: Philip Freneau Press, 1970); and Ward, *The War of the Revolution*, 1: 372-383.

2.0 Background to Revolutionary War River Defenses

2.1 Contemporary Engineering and Military Manuals

By the middle of the 18th century, military art and science, and military engineering, were well established and extensively studied. Numerous professional treatises were available to military officers and engineers to guide the use of terrain, the construction of fortifications, and nearly every conceivable aspect of military operations. A number of these treatises discussed the use of chains and other obstructions to prevent an enemy force from traversing a river. The first of these was presented by Roger, Earl of Orrery, *A Treatise on the Art of War* (1677):

There seems to be ten particulars which ought to be minded, in incamping an army in a standing camp.... VIII- If the river adjoining be navigable, or not always fordable...a competent distance above your standing camp, you must have a boom or cable under water, or chain ready to draw across the river, and to cover and well defend them at both ends.¹¹

A “Monsieur Ozanam, Professor of Mathematics at Paris,” prepared *A Treatise of Fortifications Containing the Ancient and Modern Method of the Construction and Defense of Places and the Manner of Carrying Sieges*, which was translated into English in 1727. This treatise noted:

How to Fortify a Place Situated Near a River - If the river runs through a town...to hinder surprises, the entrance must be shut up with an iron chain, sustained by little boats or logs of wood, which every night must lie quite cross the river.¹²

Both of these books would have been familiar to Kosciusko, who had received a classic education in military engineering in France, but whether or not they were available to American military engineers is uncertain.¹³ However, another military treatise was certainly available in the North American colonies prior to the commencement of the American War for Independence. This was one of a number of accomplished studies on military fortifications, engineering, art and science written by John Muller, Professor of Artillery and Fortification at the Great Britain Royal Academy of Artillery at Woolwich. In Muller’s classic *A Treatise Containing the Elementary Part of Fortification, Regular and Irregular*, published in 1746, he specifically addressed river defenses on two occasions:

But if the river is above 100 toises [640 feet] large, the building curtains across would be too expensive, in such a case a fort...may be made in the middle of it; from whence chains and booms may be laid to the shore in the night, and in time of danger.

Notwithstanding the booms and chains, which are to be laid across the river, in the night and time of danger, the enemy may find an opportunity to force his way through, whereby the place might easily be taken.¹⁴

Several different copies of Muller’s *Treatise* are included in the library of General George Washington, attesting to its availability to and use by the American Continental Army.¹⁵ Interestingly, Washington’s copy is annotated in his own hand. In a letter to John Adams regarding books upon military art and

¹¹ Roger, Earl of Orrery, *A Treatise on the Art of War* (Savoy: Henry Herringman, 1677), 121-123.

¹² J.T. DeSauguliers, Translator, *A Treatise of Fortifications Containing the Ancient and Modern Method of the Construction and Defense of Places and the Manner of Carrying Sieges, Written Originally in French by Monsieur Ozanam, Professor of Mathematics at Paris* (London: J. Jackson & J. Worrall, 1727), 148.

¹³ Although it should be noted that copies of both volumes are located in the Library at the U.S. Military Academy, West Point, New York, which was established by Superintendent Sylvanus Thayer as early as 1817.

¹⁴ John Muller, *A Treatise Containing the Elementary Part of Fortification, Regular and Irregular* (London: J. Nourse, 1746), 171-172.

¹⁵ William Coolidge Lane, *A Catalogue of the Washington Collection in The Boston Athenaeum* (Boston: The Boston Athenaeum, 1897), 539.

science, American Artillery General Henry Knox specifically recommended Muller's *Treatise*, lending further credence to its use and availability to the Colonial Army.¹⁶

Another of Muller's works, *The Attac and Defence of Fortified Places* as published in 1757, also noted:

It is not always sufficient for the Besiegers to be masters at Sea, and to block up the harbour, unless further precautions are taken; for the Besieged may watch and take the opportunity of a dark or foggy night, to pass by the fleet unperceived, with small boats, and supply the town with necessaries, and therefore a boom, or several chains, should be fasten'd cross the entrance of the harbour....¹⁷

Although the concept of stretching a heavy iron chain across a large body of water seems to be an advanced engineering project for the middle of the 1770s, such techniques had been in use for centuries.

2.2 Use of River Defensive Chains in Antiquity

The first documented use of chains and log booms to obstruct the free navigation of rivers was across the "Golden Horn" at Istanbul, installed in the 5th century A.D. An early account of this chain noted:

The location of [Istanbul] is such that a tiny branch of Bosphorus goes to its western side in the form of a horn which is known as the "golden horn." To pass through this golden horn in order to reach the port of the city or its northern rampart, the Byzantine Army had blocked the entry of golden horn through a massive chain. The Sultan's [Sultan Muhammad Faatih] navy had therefore been confined to Bosphorus only and it could not enforce the blockade to the city port.... It was Sultan Muhammad's earnest wish that somehow a part of his navy could be entered into the golden horn, then the attack on the city from the port side could become a possibility. This was a Herculean task as the mouth of the golden horn was blocked by an enormous chain, and there were also tanks ready to fire upon the entering enemy, and Byzantine ships were kept alert to defend the chain and attack the invader.¹⁸

The reference to "tanks" apparently refers to large cannon that were emplaced to command the chain. The Istanbul fortifications, including the chain, were initiated by the Emperor Theodosius II of the Eastern Holy Roman Empire in 412 A.D. The chain was anchored on both ends by large fortified towers of which one, the Galata Tower, still survives. It was noted to have been supported by floating barrels. Some links of the chain survive today in the Istanbul Military Museum.¹⁹ This chain and the city fortifications successfully protected Istanbul from attack until it was conquered by Crusaders on April 13, 1204.

Another chain is documented to have been used to block the harbor at Girne (Kyrenia) on the Island of Cyprus as early as 1300 A.D. The chain was anchored at two large fortified stone towers, and extended across the mouth of the harbor. One of these towers, "The Chain Tower," still survives at Kyrenia.²⁰ One of

¹⁶ Joseph R. Riling, *The Art and Science of War in America, A Bibliography of American Military Imprints, 1690-1800* (Alexandria Bay, New York and Bloomfield, Ontario, Canada: Museum Restoration Service, 1990), 11.

¹⁷ John Muller, *The Attac and Defense of Fortified Places* (2nd Edition, 1757: Revised Edition Arlington, Virginia: Flower-de-Luce Books, Invisible College Press, 2004), 107-108.

¹⁸ Shayk Taque Uthmaani, "Conquest of Istanbul, Sultan Muhammad Faatih's Wonderful Accomplishment" translated by Haafiz Ghulam Muhammad Bora. *RiyadulJannah Online* 4, Issue 11 Accessed on-line at <http://www.riyaduljannah.com/ArticleView.asp?ArtId=1017> on December 8, 2004.

¹⁹ "Istanbul Ramparts" accessed on-line at http://www.geocities.com/oonderer_2000/historic/507.html on December 8, 2004; Republic of Turkey Ministry of Culture, "Cultural Details of Istanbul, The Walls" accessed on-line at <http://www.discoverturkey.com/english/yeni/istanbul/walls.html> on December 8, 2004; and "Galata Tower Restoration Starts" Turkish Daily News Issue 334 (June 6, 1999) accessed on-line at http://www.turkishdailynews.com/past_probe/06_06_99/art.htm on December 8, 2004.

²⁰ "History of Girne (Kyrenia) Castle and Harbor, Cyprus" accessed on-line at: http://www.allcrusades.com/CASTLES/CYPRUS/KYRENIA/KYRENIA_TOWN/kyrenia_town_txt_1.htm and http://www.allcrusades.com/CASTLES_COUNTRIES/castles_cyprus_overview-3.html on December 8, 2004; and William Dreghorn, *A Guide to the Antiquities of Kyrenia* accessed on line at <http://www.stwing.upenn.edu/%7Edurduran/drky1.html#town> on December 8, 2004.

the towers is suggested to have protected a large stone pillar upon which the chain was anchored, and the other stone tower protected a windlass that enabled this chain to be raised or lowered. The length of this chain was approximately 300 feet.

A third historic chain is documented to have been emplaced to obstruct the harbor at Padua, Venice, Italy beginning in 1516. This 36-meter [100 feet] long chain was anchored at a strongpoint in the fortifications which encircled the town, the so-called Bastione della Saracinesca ("The Chain Bastion").²¹

The Grand Harbor at Malta, located at Galley Creek, was also defended by a hand-forged iron chain stretched between Fort St. Angelo and Fort Saint Elmo. This chain was approximately 200 meters (650 feet) in length. Two fragmentary accounts of this chain survive:

One precaution only the Order had taken. The chain was across Galley Creek, the hand-forged Venetian chain whose every link had cost the Knights [of the Order of St. John of Jerusalem] ten golden ducats. It sealed the mouth of the middle of the three blind seaways entering the long southern coast of the fjord, and from its vast capstan on the left to its rock bed on the right, joined the two tongues of land between which all the galleys and brigantines of the of the Order usually lay. On the left tongue was Birgu, the fishing village the knights had made convent and home of the Order, with the fort of St Angelo at its tip. On the right was the peninsula called L'Isla, with a watch tower....

A skiff, running alongside the shallow boats supporting the great chain from side to side of the creek, freed the middle stretch from supports, and the taught line sagged and dipped as, invisibly, the slaves below St. Angelo flung their weight on the capstan bars. De Villegagnon, silent in the bows, turned and nodded to the Master, and the Brigantine slowly gained speed and slid over the line.

This same source also noted that this chain was "permanently anchored. There was a windlass on the Fort St. Angelo side, and on the L'Isla/Senglea side the [chain] was embedded in rock. In times of crisis, the windlass was tightened and the chain was raised. In peaceful times, the windlass was unwound, and the chain rested on the bed of the creek. When the chain was raised, it was sometimes buoyed up in the centre by being tied to boats or logs, this would stop it sagging in the middle and thus permitting a small boat from sneaking over the top of it."²²

This chain and its harbor defenses successfully withstood a siege by a Turkish army in 1565. This great chain is also described in a history of this siege:

On the Senglea side, the chain was secured to a huge anchor...the anchor had been imbedded in the living rock, and then reinforced with stone outworks, so that nothing could move it. At the other end of the chain, on a specially constructed platform on the base of Fort St. Angelo, an enormous capstan controlled the chain. In normal times it was eased out and lay partially on the harbor bed... gangs of slaves began to lay their weight against the capstan bars to raise the chain. As it came taut and broke the surface of the water, Maltese boatmen rowed out, dragging wooden pontoons and rafts behind them. The chain was made fast to these at regular intervals.... The pontoons helped to keep it at water level and prevented any tendency to dig or sag toward the middle.

At one point, when Turkish forces attempted to land at the chain to outflank it, they were decimated by a hidden artillery battery guarding the chain. It is also of interest that during the Siege of 1565, that the Turkish forces "had secured their ships in these two harbors [in their rear] and had barred the entrances with chains and stakes."²³

²¹ Walled Towns Friendship Circle, "Padua's Medieval Walls" accessed on-line at <http://www.walledtowns.com/wtfc/towninfo/italy/padua.html> on December 8, 2004.

²² David Mallia, "Malta: A Case Study in the Development of Fortifications" accessed on-line at http://www.icomos-ciic.org/CIIC/pamplona/PROYECTOS_David_Mallia.htm on December 8, 2004; and "The Chain at Malta" accessed on-line at <http://www.simonhedges.com/photos/malta/birgu/stangelo/chain.htm> on December 8, 2004.

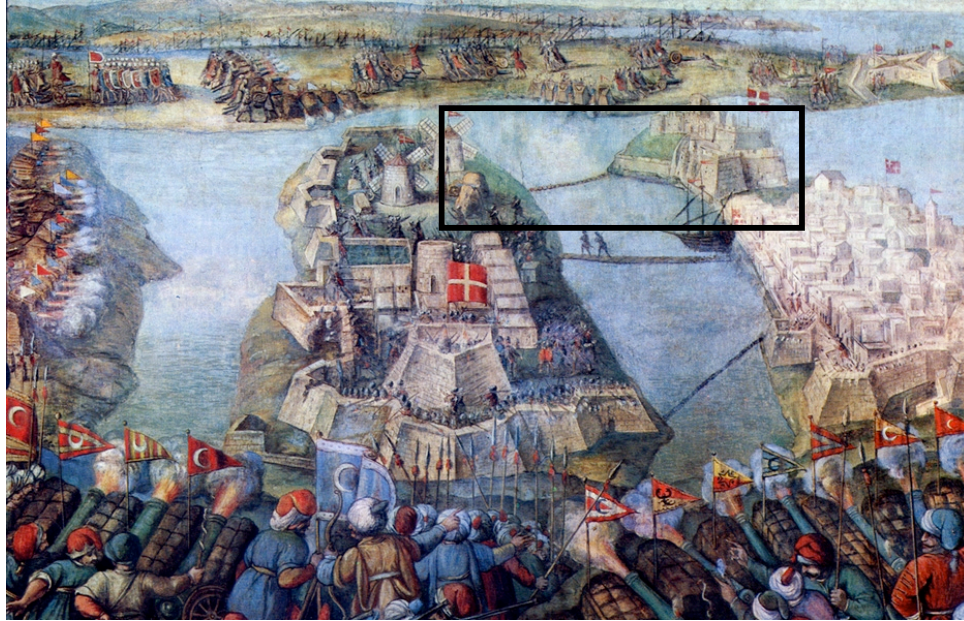
²³ Ernle Bradford, *The Great Siege* (New York: Harcourt, Brace & World, Inc., 1961), 50, 135, 142-143, 194.

Frescoes made of the Siege of 1565 document the chain, and provide representations of its appearance and design.



**Great Chain across Galley Creek, Malta
Under attack, note artillery battery defending the chain
“St. Michael Assaulted by Land and Sea, July 15, 1565”²⁴**

²⁴ Ian C. Lockhead, *The Siege of Malta 1565* (London, England: Literary Services and Production Ltd, 1970), 46-47.



Great Chain across Galley Creek, Malta
“The Investment of Fort St. Michael, June 27th, 1565”²⁵

Finally, a fifth chain is documented to have blocked the harbor at Famagusta, Cyprus. This chain is indicated on a map of a 1571 siege of the city by the Turkish Army.²⁶ As with the Girne chain, it was apparently anchored to heavy defensive towers on either end.

It is not documented whether or not American officers and engineers were familiar with these ancient chains. However, Washington is known to have been a student of Vegetius, a Roman General whose military writings were translated into English and published in 1767 as “The Military Institutes of Vegetius.”²⁷ Ancient military traditions were incorporated into the early American military traditions (as demonstrated by the Society of Cincinnati), and it is conceivable that at least some American military leaders were aware of the use of chains as river obstacles in antiquity.

2.3 Historic Experience in North America – Seven Years War

There are three documented uses of chains and/or log booms to obstruct a river during the Seven Years War in North America. All of these were constructed by the French army as defensive efforts against British incursions into New France (Canada).

Fort Carillon, located at Ticonderoga, New York, was the principal French defensive position astride the Hudson River-Lake George-Lake Champlain corridor from Albany leading into New France. During the

²⁵ Ibid., 40-41.

²⁶ “History of The Harbor of Famagusta” accessed on-line at http://www.allcrusades.com/CASTLES/CYPRUS/FAMAGUSTA/PHO_PIC_WEB/citadel-or-othellos-tower/pictures/s3500179.html and http://www.allcrusades.com/CASTLES/CYPRUS/FAMAGUSTA/MAPS/famagusta_town_map_1.html on December 8, 2004; Stefano Gibellini, “The Siege of the Turks” (1571) accessed on-line at <http://www.allcrusades.com/CASTLES/CYPRUS/FAMAGUSTA/MAPS/cyp-famagusta-Gibellini-1571/Cyp-FamagustaGibellini1571.html> on December 8, 2004; and William Dregghorn, “Famagusta and Salamis, A Guide Book” accessed on-line at <http://www.stwing.upenn.edu/~durduran/drfrm1.html> on December 8, 2004.

²⁷ Lieutenant Colonel William Goff Caples, “George Washington’s Military Guide” *The Military Engineer* XIX, No. 105 (1927), 244-247.

1759 advance by a large British force against Fort Carillon, the French defenders drove log pilings into the La Chute River between Lake George and Lake Champlain to obstruct it. The nature and extent of these log pilings is not known, although their location was recorded in a 1777 British map of Fort Ticonderoga and vicinity.²⁸ The French also constructed some type of minimal log boom across Lake Champlain.²⁹ This could not have been of particularly substantial construction, for on July 26, 1759 General Jeffery Amherst dispatched Rogers Rangers in boats with saws to cut the boom. Amherst noted in his journal for that date, "...I had ordered Major Roberts to go to night and cut the boom...."³⁰ Major Robert Rogers, commanding his famous Rangers, would similarly record in his own journal:

I this day received orders from the General to attempt to cut away a boom which the French had thrown across the lake opposite the fort, which prevented our boats from passing by, and cutting off their retreat. Rangers in one English flat-bottomed boat, and two whale-boats, in which, after night came on, I embarked, and passed over to the other side of Lake Champlain, opposite to the Rangers encampment, and from that intended to steer my course along the east-shore, and privately saw off their boom, for which end I had taken saws with me, the boom being made with logs of timber.³¹

Fort Carillon being evacuated and destroyed by the French the night of Roger's expedition against the boom, he never actually reached the log obstacle, and no additional records of this defensive measure have been located. This boom is displayed on one map of the 1759 Ticonderoga campaign, as "A work made to prevent our cutting off the enemy's retreat."³² As stated, the fact that simple saws were to be used to cut this boom suggests that it cannot have constituted much of an obstacle.

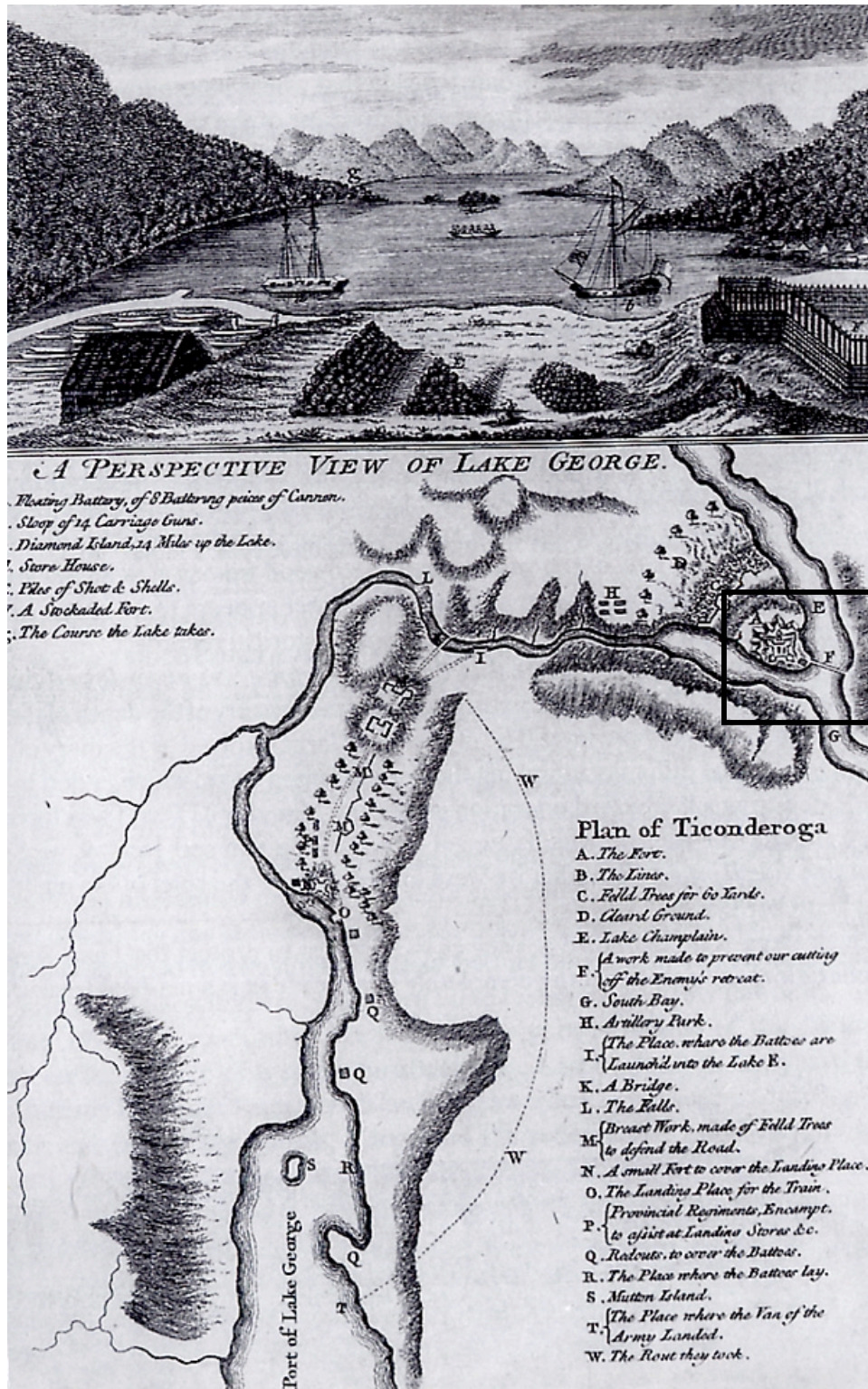
²⁸ Lieutenant Charles Wintersmith, Assistant Engineer, "Plan of Ticonderoga and Mount Hope, 1777" (Ticonderoga, New York: Fort Ticonderoga Museum).

²⁹ Edward P. Hamilton, *Fort Ticonderoga, Key to a Continent* (1964: 2nd Edition Ticonderoga, New York: Fort Ticonderoga Museum, 1995), 96.

³⁰ J. Clarence Webster, Editor, *The Journal of Jeffery Amherst, Recording the Military Career of General Amherst in America from 1758 to 1763* (Chicago: University of Chicago Press, 1931), 146.

³¹ Timothy J. Todish, Editor, and Gary S. Zaboly, Illustrator, *The Annotated and Illustrated Journals of Major Robert Rogers* (Fleischmanns, New York: Purple Mountain Press, 2002), 168.

³² Russell P. Bellico, *Sails and Steam in the Mountains, A Maritime and Military History of Lake George and Lake Champlain* (Fleischmanns, New York: Purple Mountain Press, 1992), 105, 107.



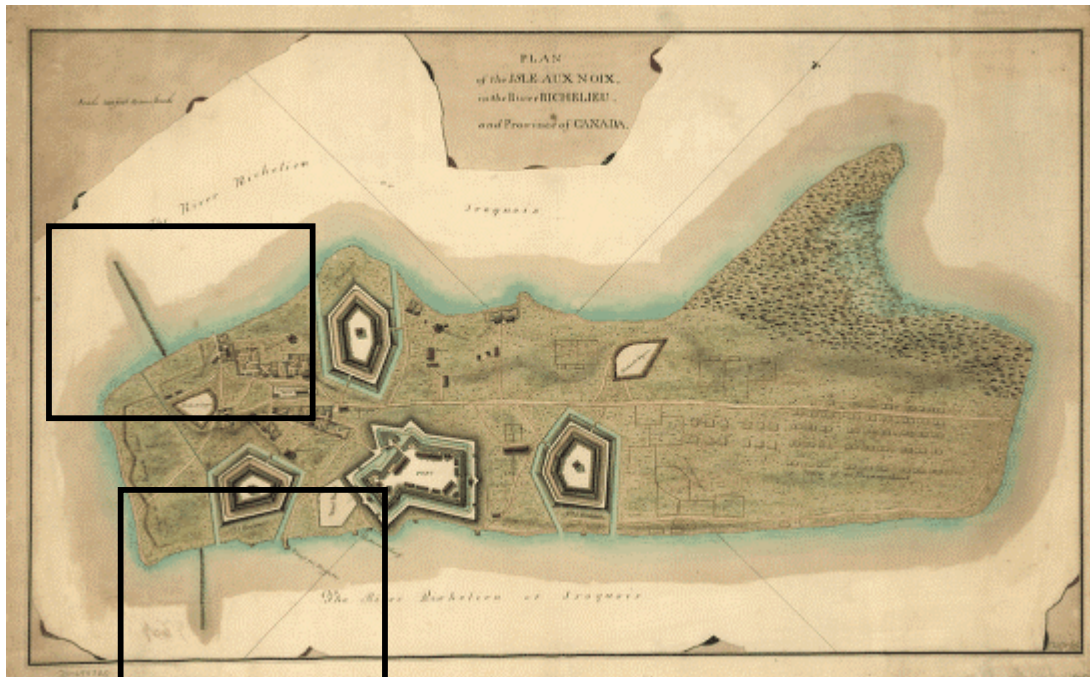
**“F- A Work Made to Prevent Our Cutting off the Enemy’s Retreat”
 From
 “A Perspective View of Lake George and Plan of Ticonderoga” (1759)³³**

³³ Bellico, *Sails and Steam in the Mountain*, 86.

Isle-Aux-Noix in the Richelieu River is a low-lying island located in the middle of the river, positioned so that artillery on the island can command both the east and west channels. Following the successful advance of Amherst's British army on Fort Carillon in 1759, French forces in the Champlain Valley withdrew to Isle-Aux-Noix to re-establish a defensive position blocking further English advances north. French engineers constructed two heavy log booms, extending from the southern end of the island across both channels.³⁴ According to Captain Joseph Bayley, a Provincial Officer from New Hampshire serving with the British Army, the French had:

...fastened 5 logs abreast with iron staples & [chain] links 1 ½ inches in diameter, the whole anchored every 10 ft. in ye ground [in the river]. The length of the boom is about 80 yds.³⁵

Although not well documented by historians who have focused their interest on the land fortifications on the island, contemporary French maps consistently indicate the presence of these two log booms and chains.³⁶ A map from the Library of Congress prepared by a Captain T. Walker of the 60th Foot in 1760 also clearly depicts these two log booms.³⁷



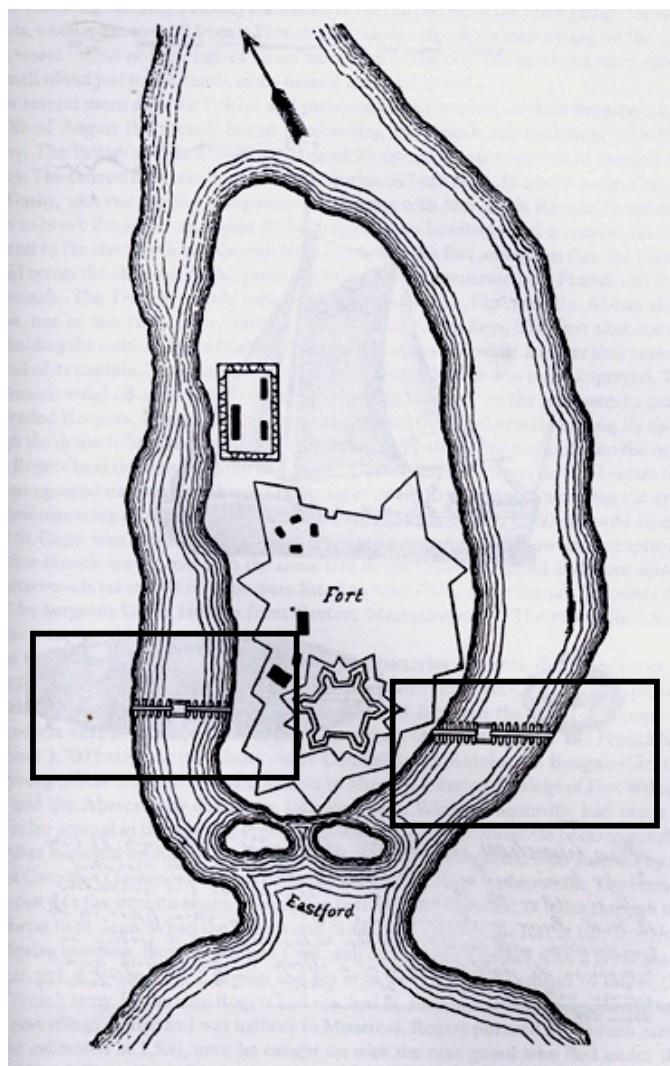
**Log Booms depicted on
Walker, “Plan of the Isle Aux Noix on the River Richelieu and Province of Canada”**

³⁴ Bellico, *Sails and Steam in the Mountains*, 86.

³⁵ Joseph Bayley, “Capt. Jacob Bayley’s Journal” in Frederick P. Wells, *History of Newbury, Vermont* (St. Johnsbury, Vermont: The Caledonian Company, 1902), 379; and Russell P. Bellico, *Chronicles of Lake Champlain, Journeys in War and Peace* (Fleischmanns, New York: Purple Mountain Press, 1999), 155.

³⁶ Andre Charbonneau, *The Fortifications of Isle Aux Noix* (Ottawa, Canada: Studies in Archaeology, Architecture and History, Parks Canada, 1994), 26, 27, 28, 30, and 32.

³⁷ Map No. 256, Peter Force Map Collection, Geography and Map Collection, Library of Congress, Washington, D.C. accessed on-line at http://memory.loc.gov/cgi-bin/query/D?gmd:3:/temp/~ammem_J11h:: on December 10, 2004.



Log Booms, "Fortifications at Isle-Aux-Noix in 1760"³⁸

Although it would not figure in the military operations around Quebec in 1759, the French army also constructed a boom of logs bound with chains and anchored in place to block the mouth of the St. Charles River, immediately to the east of Quebec.³⁹ Military maps of the operations around Quebec referred to this obstacle simply as "the boom." One observer noted of the St. Charles River defenses on June 3, 1759:

Never had works gone up so quickly, such that our general soon had the satisfaction of seeing themselves ready to receive the enemy as he came; there was no sight better than these entrenchments defended at intervals by good redoubts furnished with many cannons, two ships moored at the entry to the small [St. Charles] river with ten cannons, as well as a chain of masts that make it impossible to force entry, and the last defense is our batteries on the commissariat dock.⁴⁰

³⁸ Bellico, *Sails and Steam in the Mountains*, 105.

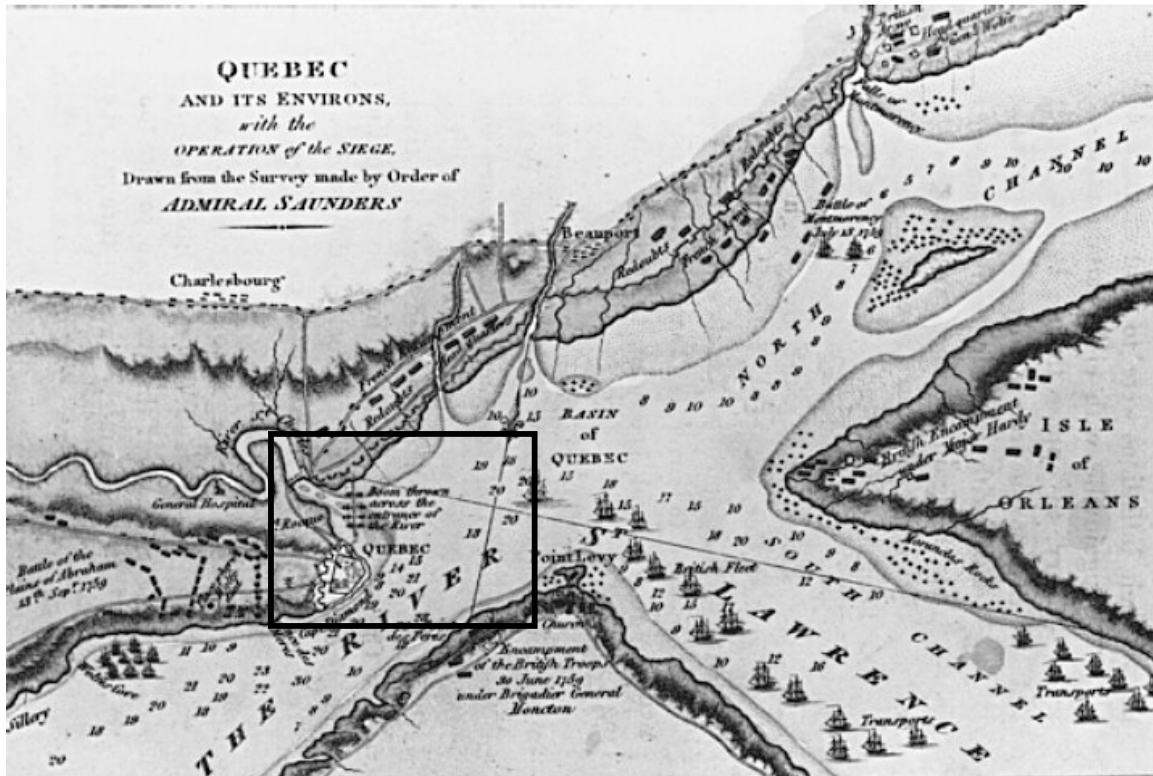
³⁹ Nigel Bly, "The Fall of Quebec" accessed on-line at <http://www.geocities.com/Athens/Academy/3967/quebec.html> on December 10, 2004.

⁴⁰ Jacques Lacoursiere, *The Battlefield, The Plains of Abraham, 1759-1760* (Sillery, Quebec, Canada: Septentrion, 2001), 6-7, 10.



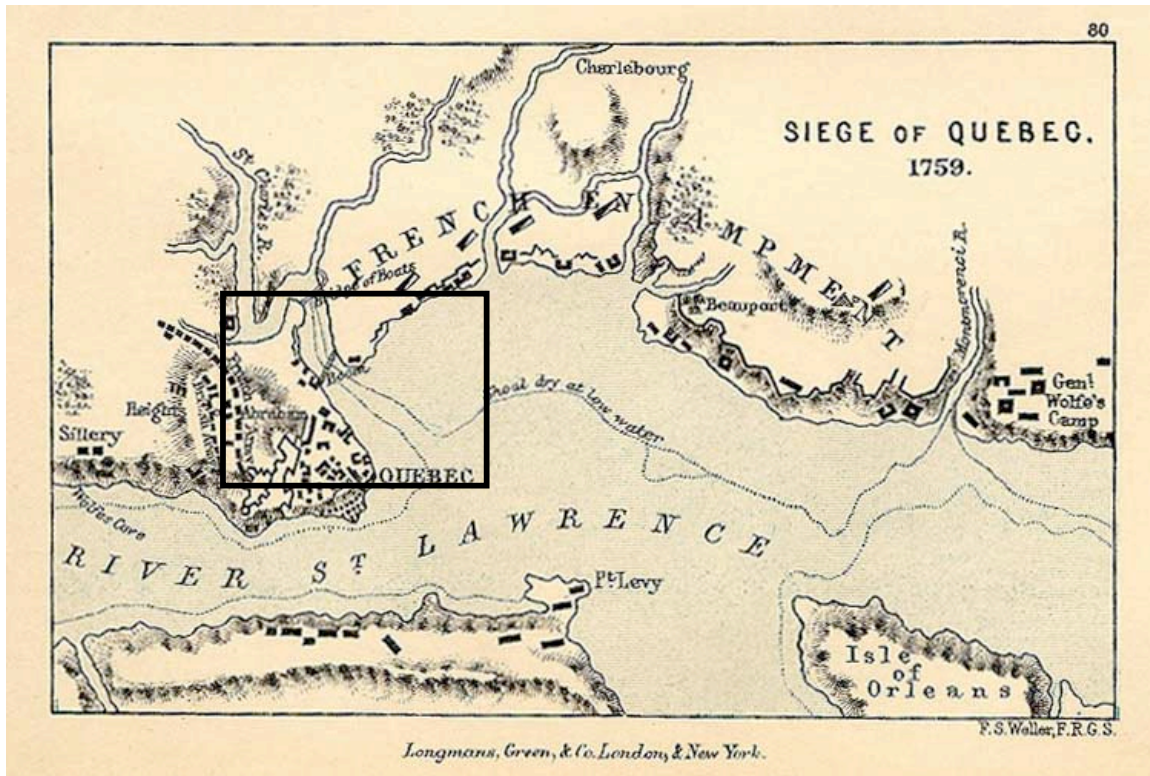
Detail, "The Boom" and "N. Battery of 4 Guns to Defend the Boom"
 Thomas Jefferys, Royal Navy, "An Authentic Plan of the River St. Lawrence (1759)"
 Massachusetts Historical Society⁴¹

⁴¹ Accessed on-line at http://www.masshist.org/maps/2739_Atlas_16/2739_Atlas_16.html# on December 22, 2004.



“Boom thrown across the Entrance of the River”
 “Map of Quebec and Environs during the Siege of Quebec,
 Which Fell to the British in September, 1759”
 National Archives of Canada⁴²

⁴² Accessed on-line at <http://www.canadianheritage.ca/reproductions/20266.htm> on December 22, 2004.



"Boom" from "Siege of Quebec, 1759"

**Samuel Rawson Gardiner, *A School Atlas of English History*
(London: Longmans, Green, and Co, 1892)⁴³**

The British armies operating against Fort Carillon, Isle Aux Noix and Quebec contained large numbers of American Provincials, many of who would later serve in the War for American Independence. As attested by Captain Bayley from New Hampshire, at least some American patriot soldiers had previous exposure to the use of log booms and chains to obstruct rivers.

2.4 Historic Experience- North America- American War for Independence 1776-1777

During the War for American Independence, a number of efforts had been instituted by the Americans to use chains and log booms to obstruct rivers. The first documented use of a chain was proposed by American commanders during the invasion of the Colony of Quebec in 1776. Although documentary evidence of this chain is limited, apparently the intent was to construct and emplace a chain across the Richelieu River at the rapids of the river between Chamblee and St. John, preventing English warships on the St. Lawrence River from sailing down this river. At least some portions of this chain were completed and shipped to Canada, but because of the precipitous American retreat it was never installed as intended. During the American withdrawal this chain was evacuated, and would eventually be emplaced at Fort Montgomery on the Hudson River.⁴⁴ On July 21, 1776 Robert Yates, Chairman of the Committee of the State of New York for the Defense of the Hudson River, wrote Major General Horatio Gates, then commanding the American field army at Fort Ticonderoga:

⁴³ Accessed on-line at <http://www.livgenmi.com/gardiner80.htm> on December 22, 2004.

⁴⁴ Arthur Cohn, *The Great Bridge, "From Ticonderoga to Independant Point"* (Lake Champlain Management Conference, Publication Series, Demonstration Report No. 4), May 1995), 11-12; Jephtha R. Simms, *The Frontiersmen of New York* (Albany, New York: 1883), I: 602, accessed on-line at <http://www.mohawkvalleyhistory.com/simmsHUDSON.htm> on December 21, 2004; and Diamant, *Chaining the Hudson*, 92-93.

As the chain intended to obstruct the navigation of the river Sorrel cannot now be applied to that use, and will serve to prevent the enemy's ships from going beyond the forts on Hudson's River, we must beg the favour of you to send the whole, or such parts of it as may expeditiously be had, to Poughkeepsie...with the utmost dispatch. We shall by this opportunity request of the Committee of Albany immediately to furnish us with one hundred and fifty sawed logs of the largest size, to support the chain.

Major General Philip Schuyler, commander of the Northern Theater of Operations, forwarded this request to Gates on July 25, 1776 with his own comments:

If the chain can be spared, I wish you would send it without delay, under the care of a careful officer to attend it to Poughkeepsie.

Gates responded on July 29, 1776:

I send you, under the care of the bearer, the chain requested by General Schuyler's letter to me of the 25th instant, and have enclosed Colonel Baldwin's (the Chief-Engineer's) invoice of the pieces and links that the whole consists of. It will be all in the boats, on the other side of the camping place, this evening, and will not, I hope, be delayed in its passage to you. I must desire you to assist the bearer in getting it forward to Poughkeepsie, as the Committee seems so anxious to have it there.⁴⁵

The next use of a chain was again in the Northern Theater, between Fort Ticonderoga and Mount Independence to obstruct the passage of Lake Champlain. There were actually two obstructions placed across Lake Champlain at this location, the first a simple log boom in 1776, and the second a considerably more advanced log boom and chain installed in conjunction with a wooden bridge connecting the two posts that was constructed over the winter of 1777.

With the destruction of the American Lake Champlain Fleet at the Battle of Valcour Island on October 11-13, 1776, the Americans moved swiftly to barricade Lake Champlain. Between October 20th and 25th the Chief American Engineer, Colonel Jeduthan Baldwin, supervised the construction of a log boom between Fort Ticonderoga and Mount Independence. Later in the month Baldwin constructed some type of temporary bridge in conjunction with this boom. Brigadier General Arthur St. Clair, who commanded a Brigade of Pennsylvania soldiers at Fort Ticonderoga, described the boom in a letter dated October 25, 1776:

When Mr. Carleton does come on we expect his march will be both by land and water. To guard against his penetrating with his vessels, part of boom was laid last night across the river [i.e. Lake Champlain] and will be completed today, and is defended by two batteries and the remains of the fleet. I scarce expect that it will resist the shock of a heavy vessel, should they have a brisk gale, but it will retard them, and as the channel is not very wide, the vessels are still be subdued when the boom is broken, but I expect a better effect from it yet, for I have no doubt of the enemies being acquainted that a boom is laid, I think as they will not know exactly its strength, they will not attempt it [at] all.⁴⁶

Because this boom was only in place for a relatively short period of time, and was apparently constructed in a hurried fashion, accounts of its construction are relatively few. The Chief American Engineer at Fort Ticonderoga, Colonel Jeduthan Baldwin, recorded of the installation of this boom:

[October] 17 [1776] Begun to make a log across the Lake or Chain to prevent Shipping coming past the Jersey Redoubt.

20 Took the distance across the Lake from the Jersey Battery & at ye Point [of Mount Independence]. Supped with General Gates. Proposed making a bridge across to Independent Point. It was approved of by the General.

22 Began to put ye Boom together.

⁴⁵ Horatio Gates Papers, Microfilm copy at Library, U.S. Military Academy, West Point, New York.

⁴⁶ Brigadier General Arthur St. Clair, Letter to Unknown, October 25, 1776, Fort Ticonderoga Museum, Ticonderoga, New York.

25 Finish the boom across & building a Bridge.

29 Finished the bridge across the Lake to Independent Point, so that men could pass.⁴⁷

One soldier described “it as a curious affair...composed of Large logs laid the Water fastened to each other with Iron & retained in place by Anchors.” This boom was apparently damaged or destroyed by ice in December 1776.⁴⁸ The Lake Champlain Maritime Museum has prepared a conceptual drawing of what this boom might have looked like, to assist with an underwater archaeological survey performed for this area of Lake Champlain in 1992-1993.⁴⁹ Regrettably, no portions of this boom were discovered during this investigation.

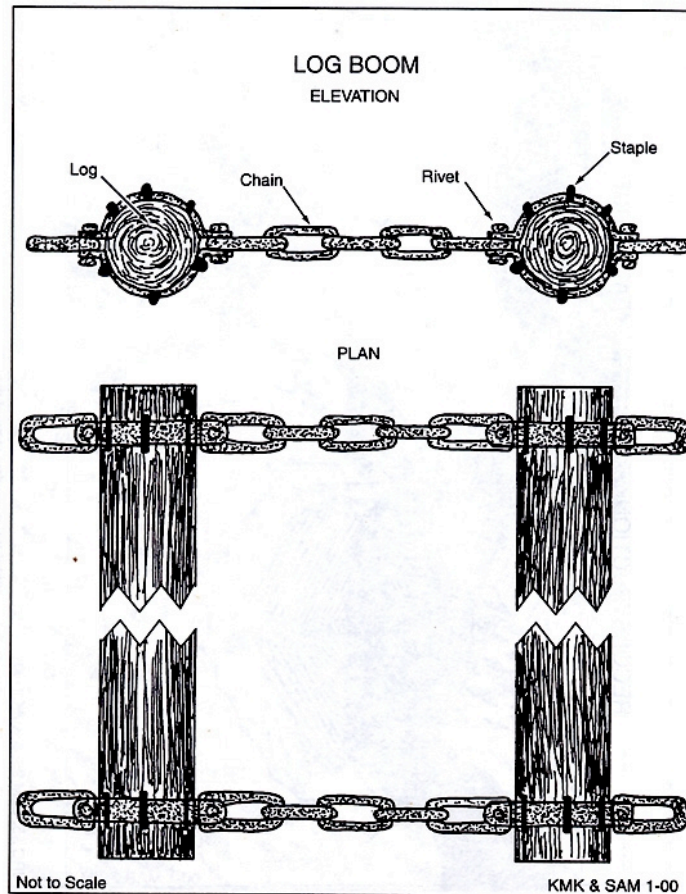


Figure 13. Conjectural view of the log boom construction (after Diamant 1985:156d-f).

**Conceptual Drawing of Log Boom, Fort Ticonderoga 1776
(Courtesy Lake Champlain Maritime Museum)**

During the winter of 1777 this expedient log boom was replaced with a permanent bridge across Lake Champlain, supported by twenty-two sturdy log caissons. A component of this bridge was a system of logs strongly fastened together with iron chains and rivets between the caissons, to reinforce the strength of the

⁴⁷ Jeduthan Baldwin, “Extracts from the Diary of Colonel Jeduthan Baldwin, Chief Engineer of the Northern Army, July 6 1776 to July 5 1777” In *Bulletin of the Fort Ticonderoga Museum* IV, No. 6 (January 1938), 27-29.

⁴⁸ The best description of this log boom is provided by Cohn, *The Great Bridge*, 12-14.

⁴⁹ Scott Arthur McLaughlin, *History Told From the Depths of Lake Champlain: 1992-1993 Fort Ticonderoga-Mount Independence Submerged Cultural Resource Survey* (Ferrisburgh, Vermont: Lake Champlain Maritime Museum at Basin Harbor, 2000), 30.

bridge against naval attack.⁵⁰ Simeon DeWitt Bloodgood, 13-years old in 1777, assisted his father with hauling timbers to this bridge, and observed its construction. Bloodgood would later record:

It was a bridge of communication built of wood, which was supported by 22 sunken pieces of large timber at nearly equal distances, the spaces between them were filled by separate floats, each 50 feet long and 12 feet wide, strongly fastened with chains and bolts. ...In front of this was a boom made of large round pieces of timber, secured by riveted bolts and double chains of inch and a half iron. It was a strong work.⁵¹

American river batteries at both Fort Ticonderoga and Mount Independence, and the surviving vessels of the American Lake Champlain Fleet operating immediately south of the boom and bridge, together comprised an effective defense scenario at Fort Ticonderoga which the British never directly challenged.

When the British forces occupied Fort Ticonderoga and Mount Independence following the American evacuation in early July 1777, Sergeant Roger Lamb with the British Army recorded:

A bridge had been constructed, and thrown over the inlet, in order to secure their own vessels, and to obstruct the British fleet. This bridge was supported by twenty-two pieces of timber, the spaces between these piers were filled with separate floats, fifty feet long, and thirteen feet wide, strongly fastened together with large iron chains. It was likewise defended, on the Lake Champlain side, by a boom composed of very large pieces of timber, fastened together by riveted bolts, and double chains.⁵²

The American forces withdrew before the strength of this chain, log boom, and bridge could be tested in battle. Without the strength of the river batteries and armed vessels, British artillery gunboats easily broke through this obstacle in the matter of a few minutes.

The fourth use of a chain was across the Hudson River at Fort Montgomery. The Fort Montgomery chain has been meticulously documented by Lincoln Diamant in his superb study, *Chaining the Hudson, The Fight for the River in the American Revolution*.⁵³ According to Diamant, the Richeleau River chain was forged at the Ancram, New York ironworks of 1 ½" square wrought iron. The Richeleau River chain was too short to extend across the width of the Hudson River at Fort Montgomery, so additional links were forged of both 1 ½" and 2" wrought iron at Ancram, and the entire chain was assembled by American blacksmiths at Poughkeepsie, New York. This "dual-citizenship" of the chain is confirmed in a report resulting from an early breaking of the chain:

Fort Montgomery, Dec. 9, 1776. These are to certify that the chain that has been stretched across the North river at this fort, has been broke twice; the first, a swivel broke, which came from Ticonderoga, which was not welded sound; the second time, a clevis broke, which was made at Poughkeepsie, in a solid part of the chain, and no flaw to be seen in any part of said chain.⁵⁴

The chain was floated on log booms. The total length of this chain was 1,650 feet, and it extended from Fort Montgomery at a slight diagonal angle to the base of Anthony's Nose. The method of fastening the chain at the east bank of the Hudson River is uncertain.⁵⁵ Contemporary maps depict a log and stone crib on the western bank of the Hudson, securing the chain underneath the guns of Fort Montgomery, and also depict a battery on the base of Anthony's Nose.⁵⁶ Twentieth century construction of the Bear Mountain Bridge destroyed all vestiges of any Revolutionary War military construction on the east bank of the Hudson. One powerful artillery battery was constructed at Fort Montgomery, being referred to as the

⁵⁰ Ibid., 282-305; and Cohn, *The Great Bridge*, 17-22.

⁵¹ Simeon DeWitt Bloodgood, *The Sexagenary; or Reminiscences of the American Revolution* (Albany: Joel Munsell, 1866), 57.

⁵² Sergeant Roger Lamb, *An Original and Authentic Journal of Occurrences During the Late American War, From Its Commencement to the Year 1783* (1809; reprint edition New York: Arno Press, 1968), 139-140.

⁵³ Diamant, *Chaining the Hudson*.

⁵⁴ Jeptha R. Simms, *History of Schoharie County* (1845), Chapter XIX, Captain Thomas Machin. Accessed on-line at <http://www.rootsworld.com/~nyschoha/simms19.html> on February 25, 2004. This source contains the most comprehensive biography on Machin, who had so much to do with the design and installation of both the Fort Montgomery and West Point chains.

⁵⁵ Diamant, *Chaining the Hudson*, 85-122.

⁵⁶ Miller, et. al, *Highland Fortress*, 118, 120.

“Grand Battery” equipped with six 32-pounders. The chain was also guarded by armed ships on the Hudson north of the chain.⁵⁷ In the event of the British assault on Fort Montgomery in October 1777 the tide and winds prevented the American ships from effectively defending the chain, and when Fort Montgomery was overrun by British land forces the chain was rapidly sundered by the British.⁵⁸

Almost immediately following the withdrawal of the British force that advanced up the Hudson after seizing Forts Montgomery and Clinton, the American defenders in the Hudson Highlands began contemplating another chain, this time at West Point. As with the Fort Montgomery chain, the West Point chain has been exhaustively documented in a number of previous historic studies.⁵⁹ The West Point chain extended 1,500 feet across the Hudson River from a cove below Fort Arnold on the western bank, to a cove just south of Marine Battery on Constitution Island. The West Point chain consisted of larger iron links than the Richeleau River/Fort Montgomery chain, 2 ½” wrought iron links, and like the previous chain was suspended on log booms. The West Point chain, at least a portion of the time, was also protected by a large log boom that was placed approximately one hundred yards downstream from the main chain. The West Point chain was apparently anchored on two large log cribs, filled with stones, located at Chain Cove and Marine Battery. No remnants or detailed descriptions of these cribs have been documented. Presumably, they were similar to the log cribs filled with stones used on the Fort Ticonderoga Bridge constructed in the winter of 1777 by Baldwin. Recent underwater archaeological efforts by the Lake Champlain Maritime Museum have located the stone-filled log cribs between Fort Ticonderoga and Mount Independence. These cribs are approximately 25 feet square, and were substantial structures. It is likely that the West Point chain was anchored to similar structures, and the fact that remnants of these cribs have survived in Lake Champlain suggests that some archaeological evidence of these anchors might still exist at West Point.⁶⁰

As the early demise of the Fort Ticonderoga chain and boom, and the Fort Montgomery chain, had proven, a large part of the strength of the chain and boom at West Point depended upon the effectiveness of the river defensive batteries. Accordingly, Kosciusko established a network of artillery batteries that were capable of placing interlocking fires upon any British ship that attempted to penetrate either the log boom or chain. On the west bank of the Hudson River, these were the Chain Battery and Lanthorn Battery (at Gees Point); on the east bank of the Hudson River this was the re-constructed Marine Battery originally constructed by Bernard Romans, and the Hill Cliff Battery. Additionally, the guns at Fort Arnold on West Point could also direct fire upon both the boom and the chain. Three more batteries were established further south to provide advanced warning of any British advance up the Hudson River, and were positioned to place preliminary fires upon any British ships before they even reached the log boom. These batteries were South Battery and Water Battery on the west bank, and the Gravel Hill Battery on Constitution Island. The other batteries designed and constructed by Romans on Constitution Island were abandoned, and never-rebuilt.

2.4 Revolutionary War Artillery Batteries- Design Specifications

As with other military fortifications, a large number of military engineering treatises provided guidelines and standardized designs for such artillery batteries. Ozanam stated regarding batteries that twelve feet must be maintained between cannon in a battery, “... thus for four pieces of cannon, the breadth of the

⁵⁷ Fort Montgomery’s history is well documented in the following: Charles L. Fisher, Editor, “*The Most Advantageous Situation in the Highlands*,” *An Archaeological Study of Fort Montgomery Historic Site* (Albany, New York: New York State Museum, 2004); and William H. Carr and Richard J. Koke, “*Twin Forts of the Popolopen*,” *Forts Clinton and Montgomery, New York, 1775-1777* (Bear Mountain, New York: Bear Mountain Trailside Museums, Historical Bulletin No. 1, July 1937).

⁵⁸ James M. Johnson, “Defending the Hudson River, 1776-1777: A Warm Reception in the Hudson Highlands, October 1777,” *Sea History* No. 98 (Autumn 2001), 11-13.

⁵⁹ Diamant, *Chaining the Hudson*, 133-174; Miller, et. al, *Highland Fortress*, 117-125; Dave R. Palmer, *The River and the Rock* (New York: Greenwood Publishing Corporation, 1969), 147-153; and Captain Edward C. Boynton, *History of West Point and Its Military Importance During the American Revolution and the Origin and Progress of the United States Military Academy* (New York; D. Van Nostrand, 1864), 48-69.

⁶⁰ McLaughlin, *History Told From the Depths of Lake Champlain*, 282-305.

battery must be about 48 feet.” He continued, “The depth of a battery is always 30 feet or thereabouts, 15 feet for the gun, 15 feet for recoil.” Ozanam also noted that the parapet which covered the cannon should be six feet high, and the embrasures three feet high “That the enemy may not see what is done in the batteries.” Regarding the flooring of the battery, he stated: “The floor or bed of the battery must be made of good oaken planks, nailed across beams, to hinder the wheels of the carriages from sinking into the ground, and that this floor or platform must incline a little, as about one foot...to check the recoiling of the pieces.”⁶¹

Extremely detailed specifications for artillery batteries were provided by Captain J.G. Tielke in his 1769 treatise *The Field Engineer*. Tielke assigned two different sizes to artillery batteries, depending upon the poundage (or caliber) of the artillery pieces. For regimental field pieces (3 or 6-pounder cannon), each artillery piece required a platform 16 feet in length, and 6-8 feet in breadth. For larger cannon (12, 18 or 24-pounders), each artillery piece required a platform 24 feet in length, and 10 feet in breadth. Tielke further noted, “If the cannon are to be occasionally fired in an oblique direction, the platforms must be broader behind than in front. In general, a difference of four or six feet is fully sufficient.” He provided specific dimensions for the artillery parapet:

That part of the parapet between the platform and the embrasure is from 2 ½ to 3 ½ feet in height. The embrasure is 1 ½ or 2 feet in width at the platform, by 5, 6 or 7 feet on the outside...and its bottom is also lowered about a foot toward the field, consequently it will be only 1 ½, 2 or 2 ½ feet above the edge of the ditch. The merlon must be at least six feet thick, otherwise it will not resist the shot which may be fired against it. In all batteries there should be a small banquette on each side of the embrasures, that the men who are employed at the guns may be able to see the effect of their fire.

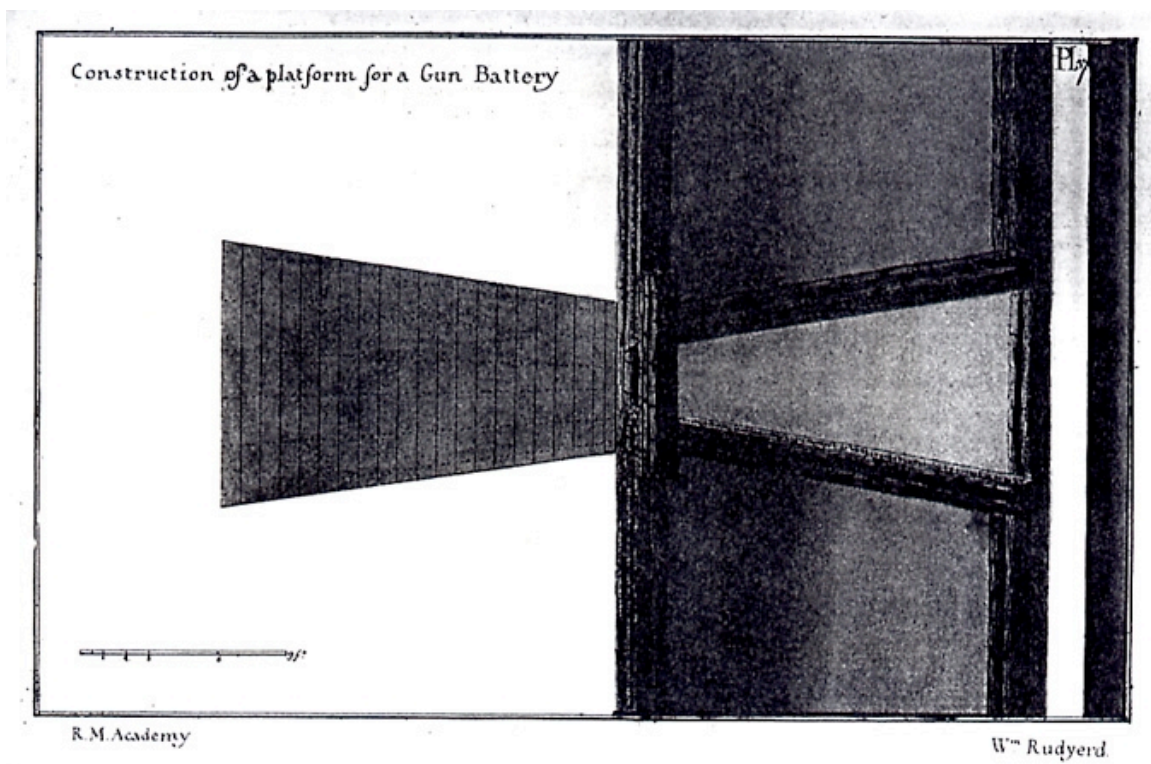
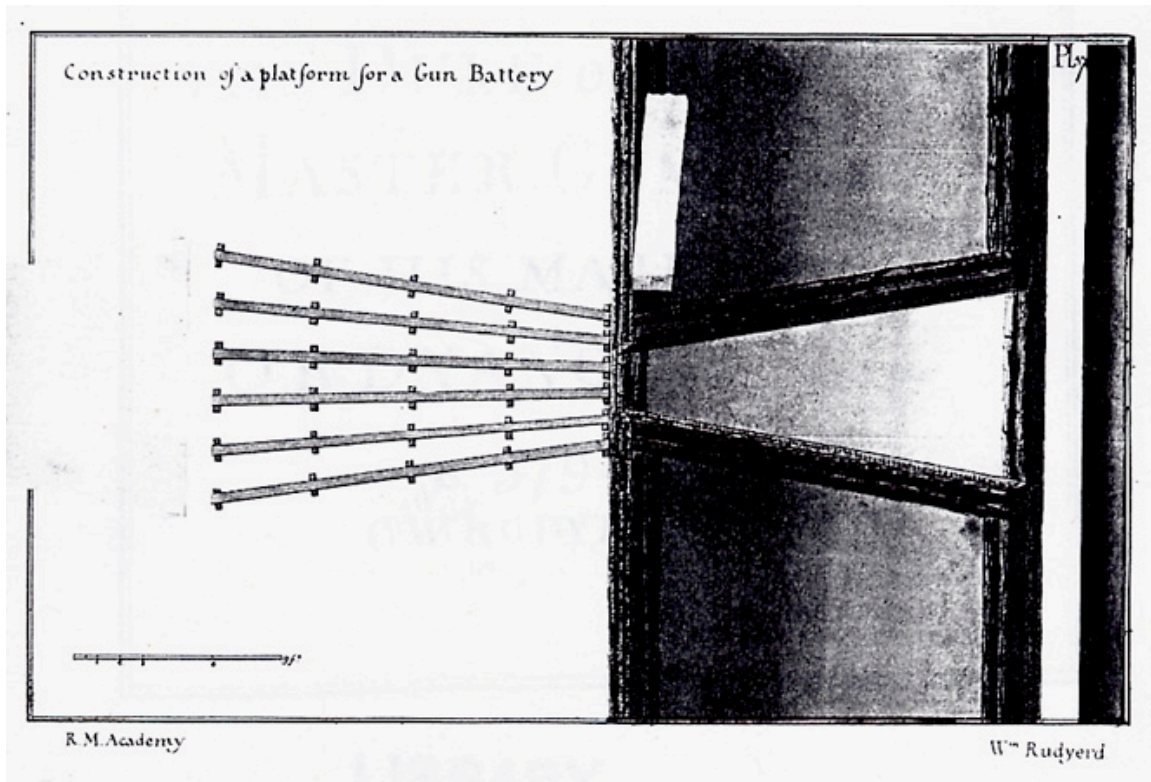
Tielke also provided specifics regarding the construction of the floors and foundations of artillery batteries. He stated that a simple firing platform should consist of three planks eight or nine feet in length, leveled, upon which the floor of the platform would be mounted. Tielke stated that the planks may rest upon strong wooden pickets, two to four feet in length. “In either case, pickets should be driven down on each side, for the purpose of fixing them in their proper places.” He again differentiated between smaller and heavier artillery pieces, “If the cannon should be very heavy, two strong beams may be buried in the earth.” Finally, he provided a third more substantial method when sufficient time and materials were available. The gun platform should be carefully leveled, “Set three or four beams or sleepers into the earth...and then add a covering of boards- fastened either with nails or wooden pegs.”⁶²

A course of instruction on artillery presented at the British Royal Military Academy shortly after the American Revolution provided two detailed plans for the platform of an artillery battery.⁶³ Although not accompanied by any narrative, these two plans (provided below) clearly indicated the supports to the joists (also sometimes referred to as the “sleepers”), the joists that ran perpendicular to the parapets, and the boards that comprised the floor of the firing platform that were laid parallel to the parapet, such as were described by Ozanam and Tielke.

⁶¹ Ozanam, *A Treatise of Fortifications*, 168-169.

⁶² Captain J.G. Tielke, translated by Ensign Edwin Hewgill. *The Field Engineer, or Introduction Upon Every Branch of Field Fortifications*. 2 volumes. (1769; revised edition London: J. Walter, 1789), 1: 301-311.

⁶³ Charles W. Rudyard, *Course of Artillery at the Royal Military Academy, As Established by His Grace, The Duke of Richmond, Master General of his Majesty's Ordnance* (Woolwich: Royal Military Academy, 1793).



Artillery Platform Design from Rudyard, *Course of Artillery* (1793)

The most expansive discussion on the design and construction of artillery batteries was provided by Guillaume Le Blond, an accomplished French Military Engineer, in his classic *A Treatise on Artillery*, first translated into English in 1746. Because this is one of the most detailed descriptions of Revolutionary War era artillery batteries, it is provided in its entirety below.⁶⁴

All places where cannon, mortars &c. are mounted, are called batteries, whether to fire on an enemy, or to attack or destroy a fortification.

In an engagement cannon are fired without being covered, that is, without there being any ground thrown up to cover or defend the persons appointed to charge and work them. For as the pieces in these cases have no fixt situation, but are perpetually changing place as the general from time to time sees proper, the difficulty of covering them is evident, and the haste, in which these kinds of actions are performed, does not permit the use of that precaution which would render the service much less dangerous. But in the attack of a place it is otherwise, the cannon are then fixt firmly each in its proper place, and it is absolutely necessary to their being made use of, that they should be placed behind a parapet, thick enough to resist the cannon shot of the besieged.

The construction of a parapet is what is properly called the construction of a battery, we shall give the particulars of it, as they stand in *M. de Vauban's* memoirs. The bed of the cannon, that is, the spot of ground on which it is placed, should, if possible, be raised some feet above the level of the field. The parapet should be three fathoms [eighteen feet] thick, and seven foot and half high. These parapets are constructed of earth, and fascines, which are a kind of faggots.

The situation and extent of these batteries are first marked out by laying down a line...this done, the ground before the battery is broke, and a small trench opened; a bed of the earth that is dug out is first laid, and well beaten down; then a layer of fascines is placed transversely upon the earth, or so that their length shall reach from side to side of the parapet, crossing it at right angles, and so alternately a bed of earth and a layer of fascines, the fascines well fastened together, and stakes driven through them, so as to make the several layers of fascines and earth, as it were, one body; both sides of the parapet are also faced or lined with fascines, laid lengthways, or parallel to the parapet, and well fasten'd with stakes to the inside of it.

This parapet being raised two feet and a half, or three feet, the embrasures must be marked out on the outside. Embrasures are well known to be openings in parapets to receive the cannon, and the part between two embrasures is called the merlon; from the middle of one embrasure to another there ought to be 18 feet, the embrasure ought to be three feet wide on the battery side, and 9 feet on the outside of the parapet. The embrasures being well marked out, the rest of the parapet, called the epaulment of the battery, must be raised, leaving the space marked for the embrasures open; that part of the parapet above the embrasures must have a proper slope, or shelving, that the materials of the parapet or the merlons may not be beat down into the embrasures. That part of the parapet, which reaches from the ground to the bottom of the embrasures, is called the knee of the battery.

The parapet being finished, platforms must be prepared against the embrasures, to place the cannon upon. These platforms are a kind of strong floors, made to prevent the cannon from sinking into the ground, and to render the working of them more easy. They are composed of joists, or pieces of wood laid lengthways, the whole length of the intended platform; and to keep them firm in the places they are laid in, stakes must be driven into the ground close to them on each side; these joists must then be covered with very thick planks, laid parallel to the parapet; and over that part of the last, which touches the inside of the parapet, a kind of thick girder, or rafter, must be placed...because when the cannon is fired, the wheels of its carriage first knock or strike against it, and afterwards recede from it, by the effort of the powder made against the breech of the piece, which is the cause of what is called its recoil, as we have said before. As a check to this

⁶⁴ Guillaume LeBlond, *A Treatise on Artillery* (London: E. Cave, 1746; reprint edition Ottawa, Ontario: Museum Restoration Service, 1970), 66-69.

recoil, and to render it as little as possible, the ground, on which that part of the platform is laid, which is farthest from the parapet, should be raised, as much as circumstances will permit, higher than the part nearest the parapet. Platforms ought to be about 18 or 20 feet long, 7 and an half wide near the parapet at their narrowest part, and 13 at the widest. When the platforms are finished, the cannon must be brought to the batteries, and placed with their carriages on the several platforms allotted them.

It is usual to make little cells or cavities near to the batteries, at a convenient distance, in which to keep the gunpowder. These cells are covered with clay, or something of the like kind, to preserve them from being fired, and are called little magazines of the battery.

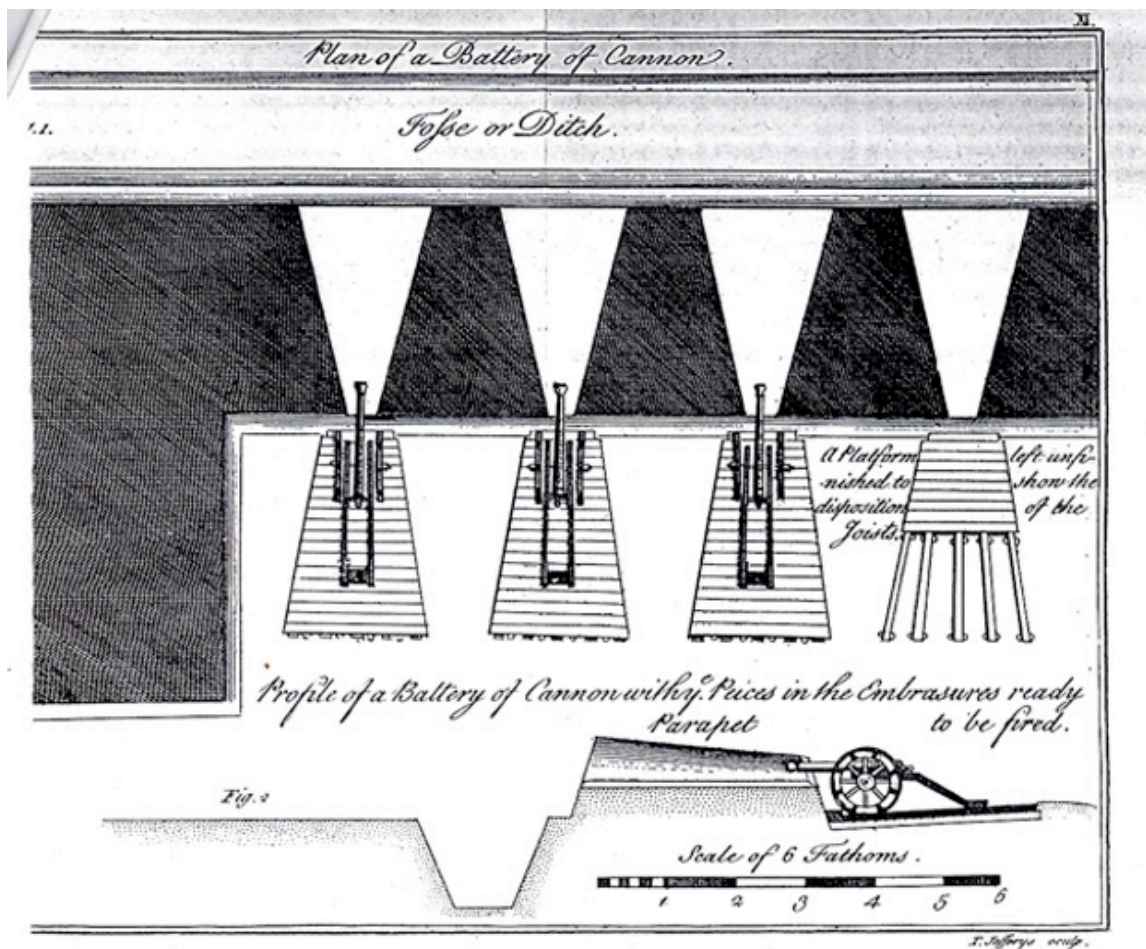


Illustration to accompany Artillery Battery description, LeBlond, *A Treatise on Artillery*

Muller also provided detailed guidance for the construction of an artillery battery in his 1757 *Treatise on Artillery*; and his 1757 *The Attack and Defence of Fortified Places*. Muller's instructions from his *Treatise on Artillery* run to several printed pages, and go into great details regarding the selection and use of materials, which although interesting and critical for successful construction of these works, are somewhat tedious. Accordingly, integral components of his battery design are abridged below:

To make a battery before the face of a vigilant enemy strong and durable, and to use no more materials and workmen than are necessary, is perhaps the most important work in a siege. From the known dimensions of a battery, the quantity of the materials may be determined and their kind from their situation. For the parapet or breast-work is 18 or 20 feet thick, and 7.5 or 8 feet high;

each gun takes up 18 feet parapet, and each end about 10, the embrasures are 3 feet from the ground, 2 feet wide within, and 15 or 16 without; so that the merlons or parts between the embrasures are 16 feet long on the inside, and 4.5 or 5 feet high. When a battery is enfiladed by some of the outerworks, they must have flanks from 10 to 12 feet thick, and 18 long. The length of platforms are commonly 18 feet, 8 feet broad before, 15 or 16 behind, the planks a foot broad, and from 2 to 2.5 thick. The hurter to stop the wheels from damaging the fascines is 5 by 6 inches square, and 8 feet long. There are five sleepers to each platform to lay the planks upon, 3 by 4 inches square, and 18 feet long, each sleeper is fastened by pickets drove fast in the ground, two at each end, and two in the middle, and the last plank by 4 to keep them close together.⁶⁵

The distance from the center of one embrasure to that of the next, is generally three fathoms of 18 feet...the embrasures are two feet wide within, and about nine without, slanting outwards about a foot and a half. Whilst the earth is throwing up for the parapet, the gunners should lay the platforms...beginning to lay five joists or sleepers longways from the parapet, securing them on both sides with stakes; then the Hurter is laid next to the parapet, which is a piece of timber about Six inches one way, and five the other; and after that the planks of about three inches thick.... The platforms are 15 feet broad behind, 9 before, and 18 long, with a lope upwards, of about nine or ten inches.⁶⁶

Muller's description of these battery emplacements is particularly important, as Muller's *Treatise of Artillery* is known to have been reprinted in Philadelphia in 1779.⁶⁷ The dedication to this Philadelphia edition was to: "George Washington, General Henry Knox and the Officers of the Continental Army."⁶⁸ This American reprint was specifically intended for use by the Continental Army. Washington also had a copy of Muller, *Treatise of Artillery*, in his personal library.⁶⁹

There are relatively few historic available illustrations of artillery batteries. One representation of the interior of an artillery battery was provided in Louis-Nicolas Van Blarenberghe's painting "The Siege of Yorktown" prepared for French King Louis XVI shortly following the conclusion of the War for American Independence (1786).⁷⁰

⁶⁵ John Muller, *A Treatise of Artillery* (1757; revised edition London: John Millan, 1780 reprinted by Alexandria Bay, New York and Bloomfield, Ontario, Canada: Museum Restoration Service, 1977), 166-176.

⁶⁶ Muller, *The Attack and Defense of Fortified Places*, 40.

⁶⁷ Riling, *The Art and Science of War in America*, 16, 44.

⁶⁸ Adrian B. Caruana, "John Muller's Treatise on Artillery" *Arms Collecting* 19, no. 2 (1981), 50.

⁶⁹ Lane, *A Catalogue of the Washington Collection*, 539.

⁷⁰ Accessed on-line at <http://www.rouillac.com/blarenberghe-en.html> on January 13, 2005.



Interior of Artillery Battery
From
Louis-Nicolas Van Blarenberghe's painting "The Siege of Yorktown" (1786)

Although only occupying a small detail of the painting, the interior of the unoccupied artillery battery with a number of prominent embrasures, and a parapet to the left, is quite apparent. Two small fleches, arrowhead shaped defensive earthworks, are depicted in front of the battery.

Certainly, as recommended by Muller, a strong network of artillery batteries was constructed directly on the Hudson River to command the chain and boom. The positioning of these West Point and Constitution Island river batteries that watched over the boom and chain was directly in accordance with the approach that was recommended by another well-established French Military Engineer, the Chevalier de Clairac:

When a rising ground or eminence runs parallel to the river, the line must be traced on it, as well as to have a command, as that the camp may be more dry and wholesome, and the communication be on firmer ground, the better for carriages. When the line thus traced is everywhere at a proper distance from the river, that is from 80 to 100 fathoms [640 to 800 feet], it is a great advantage.

It is essential here to distinguish 2 different sorts of fire, the rasant or grazing, is that which, going in a direction parallel to the horizon, beats down within its range, and sichant or plunging, that which fires from a higher on a lower place, and only damages whatever it meets with near the point where it falls.⁷¹

It should be noted that Clairac's volume was among those in Washington's personal Library.⁷² As with the works of Muller, Henry Knox was also familiar with Clairac's *Field Engineer*, and recommended it to John Adams.⁷³

⁷¹ Chevalier de Clairac, translated by John Muller, *The Field Engineer of M. le Chevalier de Clairac, from the French* (London: J. Millan, 1773), 119, 173.

⁷² Lane, *A Catalogue of the Washington Collection*, 537.

⁷³ Riling, *The Art and Science of War in America*, 11.

3.0 Fortress West Point

3.1 Fortress West Point– Critical River Defense Batteries

The four most significant river artillery batteries, based upon their positioning and their ability to place effective fires to defend the chain and boom, are Chain Battery and Lanthorn (Gees Point) Battery at West Point, and Hill Cliff Battery and Marine (Chain) Battery on Constitution Island.

Unfortunately, 19th century construction and the 20th century demolition of a lighthouse at Gees Point are believed to have destroyed all evidence of the Lanthorn Battery. Repeated pedestrian surveys of the Gees Point area by the author have been unable to locate any positive surface evidence of this battery, although a possible parapet wall may exist to the north of the historic lighthouse location directly atop Gees Point. Lanthorn Battery was located at approximately 20 feet elevation above the Hudson River, which would have enabled it to employ grazing fire (that is, fire directed horizontally at the water line of a ship). A June 28, 1779 report on ordnance at West Point indicated that Lanthorn Battery was armed with two 9-pounder cannon.⁷⁴ A September 5, 1780 ordnance report betrayed by American Major General Benedict Arnold to British Major John Andre also listed two 9-pounder iron cannon at Lanthorn Battery.⁷⁵

Chain Battery survives as a lineal dry-laid stone parapet, 65' in length, and four feet in thickness. No surface evidence of a firing platform survives. The presence of Flirtation Walk to the immediate rear of Chain Battery has probably resulted in considerable disturbance to the location where the Chain Battery's firing platform would have been located. Chain Battery is located at 27 feet elevation, which would have enabled it to employ grazing fire on the Hudson River. Although other historians have criticized the elevation of this battery, the chain was anchored immediately below the battery, and space was required for the chain's anchor point, and to enable the chain to be maneuvered and installed at this location.⁷⁶ Chain Battery appears to have been positioned as close to the river as possible, while providing for the necessary manipulations of the chain, and grazing fire would still have been possible from this position against naval vessels on the river. Only the base of the parapet survives today. However, Chain Battery's surviving parapet is too thin to have provided protection from any but the smallest artillery pieces, even on a relatively small naval vessel. Four feet of thickness, even of massive granite boulders, would only have been proof against musketry fire and small cannon such as swivel guns. Apparently Kosciusko did not believe that Chain Battery would be likely to receive any substantial artillery fire, and thus did not expend efforts on constructing a full thickness parapet. Viewed in this context, the front "parapet" of Chain Battery is not a true defensive parapet so much as a simple front support for the firing platform for the artillery pieces. The June 1779 ordnance report lists three 12-pounders at Chain Battery; the September 1780 report also lists three 12-pounders. The 65' length would have been more than sufficient to have supported three cannon if constructed according to Muller or LeBlond.

During heavy rainfall caused by Tropical Storm Jeanne on Monday, September 27, 2004 and Tuesday, September 28, 2004 approximately ten lineal feet of this battery catastrophically failed. Although unfortunate, this parapet collapse will be repaired by USMA in the spring of 2005. This collapse did provide documentation of the construction of the interior of this battery, which consisted entirely of dry-laid stone that appears consistent with other stone known to have been locally quarried from the West Point vicinity. The majority of these stones were impressively large. Photographs of the Chain Battery collapse are provided as Appendix A. The extensive use of dry-laid stones to comprise the battery parapets is in conformance with guidance provided by Muller in another of his treatises on military engineering: "When

⁷⁴ Alexander McDougall to George Washington, June 28, 1779, "Report on Distribution of Ordnance, Stores, Forage, Horses and Oxen Teams" George Washington Papers, Series 4: General Correspondence, 1697-1799, Library of Congress, accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 27, 2004.

⁷⁵ Miller, et. al. *Highland Fortress*, 184. Miller, et. al. depended upon John "Jack" Mead, *Archaeological Survey of Fort Putnam and Other Revolutionary War Fortifications, 1967-1968* (West Point, New York: West Point Museum Fund, n.d.) for most of the assessment of the surviving fortifications.

⁷⁶ Miller, et. al., *Highland Fortress*, 65-66.

the situation is rocky, care must be taken to make use of the rock for the facings of the work....”⁷⁷ Dry-laid stone is consistently used throughout the West Point fortifications, and the survival of Chain Battery from 1778 to 2004 without appreciable maintenance attests to the strength and resiliency of this type of construction, as recommended by Muller.

Marine Battery, similar to West Point’s Chain Battery, survives today as a lineal battery, with a traverse to the south, and it is anchored on a massive rock escarpment on its northern side. Marine Battery is 130 feet in length, with a ten foot dry-laid masonry parapet. This thicker parapet would have been capable of resisting up to twelve-pounder cannon fire, which would have been the heaviest cannon that British naval vessels operating on the Hudson River would have been anticipated to have employed. The gun platform appears to have been sixteen feet from the parapet to a rear platform base, four feet in width. This is consistent with the length of a firing platform in accordance with Muller or LeBlond, particularly if the actual firing platform extended two feet past the end of the rear base. Work on this battery was initiated in January 1776, as documented in a letter to the New York Committee of Safety:

The foundation of the intended Battery was completed on Sunday last, the length of which is one hundred and forty feet, the breadth at bottom twelve feet, and at the top is ten feet, and its height four feet on average. The materials are chiefly large rocks, from five hundred to one thousand weight, and some much larger, filled in with the largest stones it would take, and the small vacancies filled with coarse gravel instead of mortar, as that could not be used at this season of the year. With respect to the extension of the base to fifteen feet, it may be done, if thought necessary, at a very small expense.⁷⁸

It is important to note that this description could just as easily apply to Chain Battery on West Point, for the interior construction of this battery revealed by the September 2004 structural collapse was identical to the January 1776 description of Marine Battery’s construction.

In another letter dated January 23, 1776 the New York Committee of Safety directed the installation of the southern (or left) traverse, which was obviously completed:

A work should also be added at the left of the line, to secure the troops on the line, and the cannon and carriages, from being flanked by an enemy on the left.⁷⁹

The construction of such a flanking parapet is fully in accordance with design specifications provided by Muller and LeBlond. Archaeological investigations performed at Marine Battery in 1971 determined that the construction of the base of the parapet was in accordance with the archival evidence. Only the base of the parapet survives, and any details of the parapet or embrasures are speculative.⁸⁰ According to the 1779 ordnance report, the two Constitution Island batteries contained one 9-pounder and five 6-pounders. The 1780 ordnance report notes that Constitution Island had been increased to four 12-pounders, one 9-pounder, and five 6-pounders. Marine Battery could have contained six or seven cannon, if positioned according to Muller and LeBlond. Stirling’s 1776 report noted that Marine Battery should have eight guns, which would have resulted in a parapet length of fifteen feet per gun, which would have been slightly closer together than suggested than Muller or LeBlond, but not so close together as to endanger the defensive integrity of the battery. Marine Battery is located at 30 feet height, which would have enabled it to place marginally effective grazing fire on British naval vessels. However, this height is at the absolute limit of effective grazing fire against 18th century naval vessels, which suggests that Marine Battery, as with the other batteries designed by Romans, was incorrectly positioned. This battery should have been located lower and closer to the river to provide for more effective grazing fire. Marine Battery was occupied by the British in October 1777, and was damaged or destroyed when the British withdrew. Its re-construction was initiated following an August 1778 inspection visit by the French Engineer Duportail, serving as the Chief Engineer for the Continental Army. Duportail stated regarding Constitution Island:

Altho it is equally necessary to secure the chain on the left hand shore of the river- it seems to have been little attended to- there is no inclosed work on this side to hinder the enemy from

⁷⁷ John Muller, *A Treatise Containing The Practical Art of a Fortification, In Four Parts* (London; J. Millan, 1755), IV:134.

⁷⁸ Dr. Edward B. Jelks, *Archaeological Investigations at Constitution Island, United States Military Academy, West Point, New York, 1971* (West Point, New York: The West Point Fund, 1972), 20.

⁷⁹ *Ibid.*, 20-21.

⁸⁰ *Ibid.*, 19-29.

debarking a sufficient number of men to get possession of the ground, and cut the chain. There is only a battery which may answer some good ends- but cannot prevent the enemy from moving as above mentioned- with three small works we shall render this point perfectly secure- the first to be placed where the block house of Fort Independence [i.e. Romans Blockhouse, this redoubt was never constructed] stood- it is sufficient for it to contain about sixty men- its end is to afford an immediate defense to the chain and its extremity.... The second Redoubt should be placed on a steep eminence which commands all the other rising ground on the island. The third on an eminence in the rear of the newly constructed battery- these two redoubts ought to be made for 150 men or 200 at most- **There is a battery, the remains of which are still in existence, below Fort Independence [i.e. south of or below Romans works]- it was perfectly well placed for battering the enemys ships- it ought to be rebuilt with a strong parapet of earth- and as this battery is low and exceedingly exposed to a plunging fire from the tops of ships- the parapets must be high, and terminated by a roof of thick plank for the protection of the cannoneers-** this battery as well as that which is just finished, will be interlocked by the three redoubts – and be in perfect safety with these works we shall be completely master of the island.⁸¹

The battery that Duportail proposed is almost certainly the Marine Battery, as both the Hill Cliff Battery and Gravel Hill Battery were too high in elevation to be “exceedingly exposed to a plunging fire from the tops of ships.”

Apparently Duportail’s recommendations were implemented on Constitution Island, including the reconstruction of Marine Battery.⁸² Marine Battery is also referred to as the “Chain Battery” on Constitution Island. An August 1779 inspection of the West Point works noted that Marine Battery should be armed with three 12-pounder cannon, which could easily have been accommodated at this battery.⁸³ It is important to note that the construction methods for both Chain Batteries (Marine Battery on Constitution Island and Chain Battery at West Point) are nearly identical.

Little of Hill Cliff Battery survives today. Only the base of a few sections of the parapet remains. The extant parapet segments suggest that the base of the parapet at least was dry-laid masonry, similar to redoubts and other West Point fortifications. The thickness of the parapet cannot be ascertained from the surviving remnant. The battery has been surmised to have been 77’ in length, and “C” shaped with traverses on either side of the main parapet. The depth of the work has been surmised to be 26’ feet, which would have been sufficient to have provided protection from flanking artillery fires for the firing platforms.⁸⁴ Assuming a standard length for the firing platforms of eighteen feet per Muller or LeBlond, this suggests an eight foot parapet. Again, such a parapet would not be thick enough to stop heavy artillery broadsides from navel vessels, although it would have been proof against smaller 6-pounder or 9-pounder field cannon. According to the 1779 ordnance report, the two Constitution Island batteries contained one 9-pounder and five 6-pounders. The 1780 ordnance report notes that Constitution Island had been increased to four 12-pounders, one 9-pounder, and five 6-pounders. Hill Cliff Battery could have contained three to four cannon, if positioned according to Muller and LeBlond. An inspection report by American General Lord Stirling of Constitution Island’s fortifications in June 1776 noted that Hill Cliff Battery should have three guns, which is consistent with the size of the battery.⁸⁵ Hill Cliff Battery is located at a 59 foot height above the river; this height meant that this battery would have employed plunging fire vertically

⁸¹ Author’s emphasis. Louis le Beque du Portail to General George Washington, “Fortifications in New York Highlands in French with Translation” August 13, 1778, George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 29, 2004.

⁸² Palmer, *The River and the Rock*, 173-178.

⁸³ Alexander McDougall, Henry Knox, and Louis le Beque du Portail to General George Washington, “Estimate of Cannon Necessary to Defend West Point, New York,” August 20, 1779. George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 27, 2004.

⁸⁴ Miller, et. al., *Highland Fortress*, 45-46.

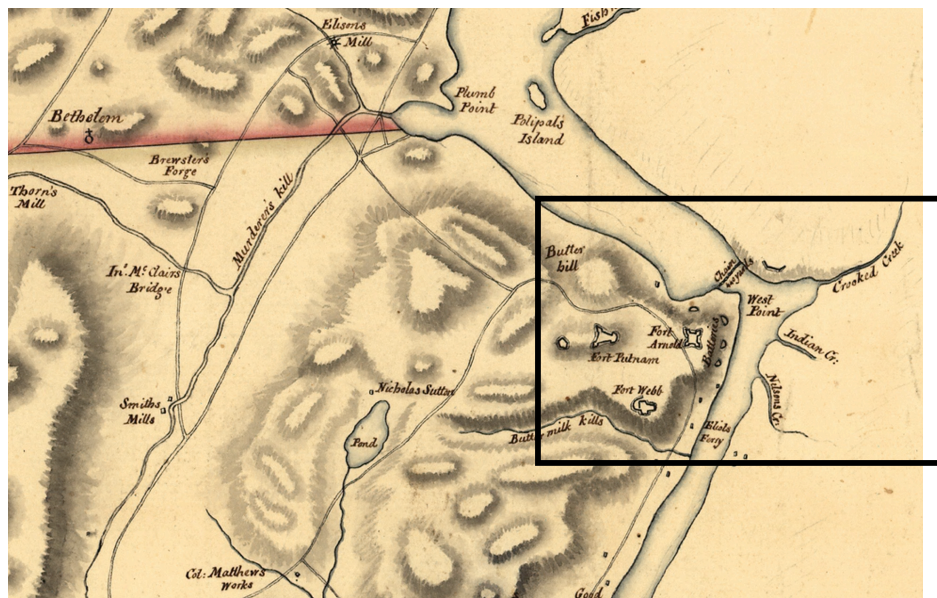
⁸⁵ *Ibid.*, 41, 44.

against the top decks of an approaching naval vessel. Hill Cliff Battery was occupied by the British in October 1777, and damaged or destroyed by them.

Although it is not certain that Hill Cliff Battery was reconstructed, its topographical position is considerably more militarily effective to defend the chain and boom than that of Gravel Hill Battery, and the author believes that it was this Constitution Island battery that was reconstructed in 1778 rather than Gravel Hill Battery. Lending credence to this argument is that French Engineer DuPortail complained in August 1778 that the “newly constructed battery [on Constitution Island] cannot prevent the enemy from disembarking.” DuPortail could not have been referring to Gravel Hill Battery, as this battery’s location enabled it to control approaches and landings on Constitution Island from the south. Hill Cliff Battery, however, was not positioned or aligned to interfere with any British approach or landings on the island. Further supporting this premise is the November, 1780 report of French Engineer Jean B. Gouvion:

Constitution Island.... One of the Water Batteries is finished, there is one begun for the defense of the chain, another is to be erected for the same object and to hinder the enemy from getting on the upper part of the river by the way of the creek with small armed boats.⁸⁶

The “one begun for the defense of the chain” must refer to the Marine Battery (or Constitution Island Chain Battery). The “another is to be erected for the same object and to hinder the enemy from getting on the upper part of the river by way of the creek with small armed boats” is most interesting. The “creek” must refer to Constitution Island Marsh, as no other water features would permit “small armed boats” to “getting on the upper [northern] part of the river.” Given this description, this battery location cannot be Hill Cliff Battery, as it does not control (or even have observation) upon the entrance to Constitution Island Marsh because of the positioning of the battery and embrasures, and intervening terrain to the south. By process of elimination, the location of Gouvion’s “battery to be erected” must be Gravel Hill Battery. If Gravel Hill Battery had been re-constructed at this time, it would control the entrance to Constitution Island Marsh. The “one of the Water Batteries is finished” can therefore only refer to the Hill Cliff Battery. Both the Gouvion and DuPortail engineering reports are consistent. Lending further credence to this is a 1780 map from the Library of Congress, believed to be one of the “spy” maps acquired by British General Henry Clinton. Although only one battery is depicted on Constitution Island, its location is most consistent with Hill Cliff Battery rather than Marine (Chain) Battery or Gravel Hill Battery.



West Point and Constitution Island
“Operations in America 1780”⁸⁷

⁸⁶ Jean B. Gouvion, “West Point, New York Works,” November 2, 1780, George Washington Papers, Series 4: General Correspondence, 1697-1799, Library of Congress, accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 29, 2004.

Finally, Fort Arnold's (later Fort Clinton) location on top of the Hudson River bluff was also integral to defense of the chain and boom. Fort Arnold was heavily armed, with two 18-pounders, three 12-pounders, two 9-pounders, eight 6-pounders, two 4-pounders, nine 3-pounders, one Royal (5 ½") howitzer, two 8-inch mortars, and five Royal (5 ½") mortars according to the 1779 ordnance report. The 1780 ordnance report notes that the Fort Arnold armament was increased to one 24-pounder, six 18-pounders, one 12-pounder, one 4-pounder, three 3-pounders, five 8-inch mortars, five Royal (5 ½") mortars, and one Coehorn (4 2/5") mortar. Of course, all of these artillery pieces would not have been oriented towards the Hudson River. Still, Fort Arnold's 157 foot elevation allowed it to place extremely effective plunging fire upon both the chain and the boom. It should be noted that of the various West Point fortifications, only Fort Arnold (and Fort Putnam) were equipped with howitzers and mortars which would have been considerably more effective when employing plunging fire. Duportail noted in his August 1778 inspection: "Fort Arnold appears to me to be quite well situated and traced."⁸⁸

Analysis using the recently established GIS capabilities at the U.S. Military Academy reveals how well positioned the river batteries of Marine (Chain) and Hill Cliff Batteries on Constitution Island, and Chain and Lanthorn Batteries on West Point, were to control any British naval vessel attempting to penetrate either the log boom or chain. For all points on the log boom, Lanthorn and Hill Cliff Batteries could have engaged a vessel broadside from both east and west, while Chain and Marine Batteries would have placed fire across the bows from both east and west. For all points on the chain, Chain and Marine Batteries could have engaged a vessel broadside from both east and west, while Lanthorn and Hill Cliff Batteries could have placed artillery fire across the stern from both east and west. For both the log boom and chain, the guns of Fort Arnold could have placed effective plunging fire. There are no points on either the log boom or chain from which a British vessel attempting to progress to the north would not have been engaged from five different directions. The ranges across the Hudson River were all well within the "point blank" or most effective range capabilities of the artillery pieces emplaced at the river batteries and Fort Arnold. Additionally, both Lanthorn and Hill Cliff Batteries were positioned such that intervening terrain protected them from artillery fire from any British naval vessel downstream from the river obstacles. Chain Battery at West Point and Marine Battery at Constitution Island were also screened by intervening terrain until a British vessel could be engaged by artillery from all four batteries and Fort Arnold. Thus, any British vessel would not have been able to engage the artillery batteries until it would have been under direct artillery fire.

Capabilities of British Artillery during War of American Independence⁸⁹

Artillery Piece	Maximum Range (yards)	"Point Blank" Range (yards)
6-pounder	3,330	666
9-pounder (Lanthorn Battery)	3,580	716
12-pounder (Chain Battery)	3,665	733
18-pounder	3,080	615
24-pounder	3,250	650

⁸⁷ "Operations in America No. 2, 1780" Peter Force Collection, Geography and Map Division, Library of Congress, Washington, D.C. accessed on-line at http://memory.loc.gov/cgi-bin/query/D?gmd:20:/temp/~ammem_xSeE:: on January 10, 2005.

⁸⁸ Du Portail, "Fortifications in New York Highlands."

⁸⁹ T.A. Fortune, *The Artillerist's Companion, Containing the Discipline, Returns, Reports, Pay, Provision, &c. of that Corps in Field, In Forts, At Sea, Etc.* (London: J. Millan, 1778; reprint edition Bloomfield, Ontario and Alexandria Bay, New York: Museum Restoration Service, 1992), 11.

INSERT GIS FIGURE 1

INSERT GIS FIGURE 2

INSERT GIS FIGURE 3

3.2 Fortress West Point– Other Batteries

A number of other artillery batteries were constructed at West Point. These batteries were of less importance than the critically positioned Fort Arnold, Marine Battery, Hill Cliff Battery, Chain Battery, and Lanthorn Battery. Other River batteries included Water Battery, South Battery, and Redoubt Sherburne at West Point; and Gravel Hill Battery at Constitution Island. Artillery batteries oriented for land defense were also located at Redoubt One (two detached batteries), Redoubt Two (one detached battery), Redoubt Three (one detached battery), Redoubt Wyllis (one detached battery), and Battery Miegs with its connecting works. Additionally, a detached battery constructed in 1779 as a guard post at the site of abandoned Fort Montgomery and known as “Putnam’s Battery” should also be considered to be a component of the West Point river defenses.

Only a small portion of Water Battery survives today. Water Battery’s extant parapet is a forty foot lineal dry-stacked masonry wall that is approximately four feet thick.⁹⁰ This battery is also known as the “Green Battery” in some official military correspondence. The thickness of this parapet, as with the Chain Battery, is not adequate to resist artillery fire. Not enough of this battery survives to make any further assessment from its surface features. The presence of Flirtation Walk immediately to its rear has resulted in considerable ground disturbance to the battery. The 1779 ordnance report lists one 12-pounder positioned at Green Battery. The 1780 ordnance report no longer lists any artillery at this battery. This battery is located at 85 feet elevation, which would have limited its artillery to plunging fire. Because of intervening terrain of Gees Point, this battery is not capable of placing artillery fire on either the chain or the boom. The author believes that Water Battery was never intended to be anything more than a guard post positioned to provide advanced warning for the four more important river batteries.

South Battery was located to the south of Water Battery, immediately east of present-day Lincoln Hall. The 19th century Battery Knox was most likely constructed in close proximity to the South Battery site. Knox Battery, and the subsequent erection of Lincoln Hall in the 1930s, is believed to have destroyed all vestiges of this battery. The intent of South Battery is uncertain, as it did not appear to offer any advantages to the defense of the Hudson River.⁹¹ As with Water Battery, because of the intervening terrain of Gees Point its guns could neither defend the chain or the boom. Its height, equivalent to that of Water Battery, limited its guns to plunging fire. In 1779 South Battery was noted to have two 9-pounders, and the 1780 ordnance report indicated a significant augmentation of South Battery which now had four 18-pounders and one 12-pounder. The commitment of such substantial armament to South Battery is a strong indication that the Americans considered this battery to be an important position. The author speculates that South Battery was intended more to secure the southern flank of Fort Arnold from a land advance by the British army, than to inhibit a naval approach up the Hudson.

Redoubt Sherburne was located to the north of Fort Arnold, at the present day location of Trophy Point. No surface features from Redoubt Sherburne remain today, and even the precise location is less than certain. This redoubt is depicted in various configurations, and at various locations, on contemporary maps. Redoubt Sherburne was located at 150 feet elevation, which enabled it to place effective plunging fire upon the Hudson River. However, because of intervening ground, artillery at Redoubt Sherburne would not have been able to defend either the chain or the boom. In 1779 this redoubt was armed with three 9-pounders and two 6-pounders. By 1780 this armament had been reduced to five 6-pounders. Because of its location to the north of Fort Arnold on The Plain, this redoubt was most likely intended to assist with the defense of Fort Arnold, rather than the Hudson River. Other historians have concurred with this interpretation.⁹² This redoubt was apparently not considered to be of great importance to the overall defensive configuration of West Point. Gouvion’s 1780 engineering report noted, “Sherbourne redoubt was built in fascines in beginning the works, and now falls down, but it is of so little consequence that it is not to be repaired” and this redoubt was subsequently abandoned.⁹³

⁹⁰ Miller, et. al., *Highland Fortress*, 67.

⁹¹ Ibid., 90.

⁹² Ibid., 94, 100-101.

⁹³ Gouvion, op. cit; Miller, et. al., *Highland Fortress*, 185; and Palmer, *The River and the Rock*, 300-301.

Gravel Hill Battery at Constitution Island is considered by several histories to have been a major component of the West Point river defenses.⁹⁴ Gravel Hill Battery was originally constructed in 1776, and was subsequently destroyed by the British occupation of Constitution Island in October 1777. The author believes that Gravel Hill Battery was re-constructed following Gouvion's inspection of the West Point defenses in 1780. This battery is also alternately referred to as Greateon's Battery or the Grand Battery.⁹⁵ Gravel Hill Battery is located on a prominent knoll that faces down the Hudson River, providing long range fields of fire against any approaching naval force. However, Gravel Hill Battery would have been forced to fire directly down the bows of any ship, which would have made effective gunnery for the relatively poorly trained American artillerymen considerably more difficult. Gravel Hill Battery's right (north) flank is anchored on a prominent rock outcropping, similar to Marine Battery. Although this provides a secure flank to the battery, this mass of rock prevents Gravel Hill Battery from placing fire upon the chain, and only portions of the boom would have been defensible from this battery. Gravel Hill Battery is located at an elevation of 55 feet, which would require it to employ plunging fire. Gravel Hill Battery survives today and is an extensive work, constructed with a prominent parapet facing down the river (Constitution Island south), and a traverse parapet to the left that would have defended the battery from an attack from Constitution Island Marsh. A ditch was constructed at the front of the main parapet. Gravel Hill Battery is the only West Point battery believed to have been constructed with a ditch. The work appears to have been constructed entirely of earth, presumably with fascines, gabions and/or sod. The parapets, although in poor preservation condition today, appear to have been approximately ten feet thick, which would have been adequate for defense against heavy artillery fire, although not as thick as specified by Muller or LeBlond. The precise number of artillery pieces employed at this battery is unknown, as the Constitution Island guns are grouped together in both the 1779 and 1780 ordnance reports. No discernable embrasures survive at this battery. The position is large enough to have employed a relatively great number of artillery pieces. As with South Battery at West Point, the author believes that this battery served more to defend the southern approach to Constitution Island, than to defend the Hudson River.

Finally, a small battery was located on the site of Fort Montgomery in 1779. This battery, known as "Putnam's Battery" was apparently intended to serve as an outpost to the major West Point fortifications. Little is known of its history, intention, design or construction. Apparently the battery was designed for three cannon based upon surviving embrasures; although no reports listing artillery pieces assigned here has been located. It is unlikely that artillery would have been positioned in such an advanced (and exposed) position, although it is conceivable that one small artillery piece might have been positioned there to provide an audible warning. Construction of an interpretive platform at Fort Montgomery State Park has covered the interior of this battery, and construction details are no longer visible.

Although not properly a component of the river defenses of West Point, two of the batteries intended to defend the river defenses from a land attack are deserving of particular attention, principally because their surviving conditions offer an enhanced opportunity for study of the construction of artillery batteries at West Point.

The Detached Battery located immediately south of Redoubt Wyllis remains in the best state of preservation of any West Point artillery battery (Photographs and a plan of this battery are provided as Appendix B).⁹⁶ This battery is generally "V" shaped and is oriented to defend against a potential British land attack from the south-southeast. The two interior faces of the battery are each 42 feet in length; the exterior faces of the parapet are each 60 feet in length. Each face of the battery contains two prominent embrasures. The size of the battery is more than adequate to employ four guns, per Muller and LeBlond. The June 1779 ordnance report only listed one 4-pounder for Redoubt Wyllis, most likely employed inside the redoubt itself, suggesting that the battery was not finished as of this date. The September 1780 ordnance report provides for two 18-pounders and four 3-pounders at Redoubt Wyllis, which would be consistent with four guns (presumably including the larger 18-pounders) emplaced at the detached battery, and a smaller 3-pounder within the redoubt. Assuming an eighteen feet width for each gun, the battery interior

⁹⁴ For example, see Miller, et. al., *Highland Fortress*, 173.

⁹⁵ Miller, et. al., *Highland Fortress*, 45.

⁹⁶ For more comprehensive information on Redoubt Wyllis, refer to Cubbison, "Historic Structures Report-Redoubt of West Point."

would have provided adequate spacing for "... a small banquette on each side of the embrasures, that the men who are employed at the guns may be able to see the effect of their fire" in accordance with Tielke as previously referenced. The south and southeastern parapets are eleven feet thick, which would have been sufficient to defend against heavy artillery. The western (right) flank of the battery was protected by a heavy parapet of nineteen feet thickness, which would have been adequate to protect the western flank of the battery against all but the heaviest siege artillery. The placement of this parapet is in accordance with the recommendations of Muller and LeBlond, although this parapet is thicker than suggested by either of these engineers. Muller specifically noted: "If the Battery happens to be flanked by any of the works of the town, the flanks must be covered by a parapet of 10 or 12 feet thick."⁹⁷ The firing platform extends 24 feet to the rear of the parapet, which is a greater length than called for by contemporary military engineers such as Muller or LeBlond. The battery contains two particularly intriguing features.

First, well-preserved stone supports for the artillery firing platform remain. These supports are made of dry-laid stone, and are approximately two to three feet deep, two to three feet apart, and two to three feet wide.⁹⁸ These supports would have been used to hold the large wooden joists upon which the firing platform floors were nailed to. The use of such stone supports is a distinctive West Point design. Similar supports have only been previously reported at Mount Independence, at a Revolutionary War battery constructed there in 1777. Interestingly, both batteries were designed by Kosciusko, strongly suggesting that this was an adaptation of his own design. This support appears to offer a better means of constructing a firing platform on particularly stony or rocky ground (conditions which exist at both Mount Independence and West Point), and also appears to be less susceptible to rotting caused by contact with wet or moist ground than conventional wood firing platform construction. Such supports would have resulted in a particularly strong and stable firing platform, as evidenced by their survival today. The detached battery at Redoubt Wyllis is the only West Point battery that positively displays such stone supports. However, archaeology has not been performed at any of the other artillery batteries, and it is conceivable that the sub-surface foundations of similar stone supports exist at other West Point batteries. The spaces between the stone supports would have been comparatively dry (in fact, they remain dry today) and fireproof, and would thus have offered excellent storage locations for ammunition and other necessary artillery stores. This would have been in conformance with LeBlond's recommendations:

It is usual to make little cells or cavities near to the batteries, at a convenient distance, in which to keep the gunpowder. These cells are covered with clay, or something of the like kind, to preserve them from being fired, and are called little magazines of the battery.

It is conceivable that the additional length of the firing platform was to provide easier access to the ammunition stored in the stone recesses underneath the platform floor.

Second, to further protect the southwestern corner, presumably the most vulnerable to attack, an epaulment was constructed to strengthen this point on the battery. This massive square epaulment added approximately six feet to the thickness of the parapets, making it proof against even the largest siege artillery. It should be noted that previous studies have incorrectly identified the entire western parapet as an epaulment, and have failed to recognize the significance of the actual square epaulment at the southwestern corner. Surviving epaulments at field works are extremely rare. In fact, this is the only surviving example from a field work of which the author is aware of on the North American continent.

The use of epaulments was well defined by military studies of the mid 18th century. Tielke noted of epaulments:

They are not intended to keep off the enemy, but merely to resist his shot. Consequently, they must be of sufficient strength, from eight to twelve feet in height, as circumstances may require.⁹⁹

The Redoubt Wyllis epaulment is not as thick as Tielke recommended. Captain Thomas Simes, who prepared several military treatises including a widely utilized dictionary of military terms that was subscribed to by such well-known Revolutionary War British general officers as Henry Clinton, John Burgoyne, Earl Percy, and St. Leger, provided the following definitions:

⁹⁷ Muller, *The Attack and Defense of Fortified Places*, 40.

⁹⁸ There is considerable variation in the dimensions of these supports, ranging from 24" to 44." Most of the stone supports are between 24" and 38" in dimensions.

⁹⁹ Tielke, *The Field Engineer*, 2:6.

Epaulment- A work raised either of earth, gabions, or fascines, loaded with earth to cover side-ways.... Also a kind of breastwork, to cover the troops in front, and sometimes in flank.... A mass of earth...A Square Orillon.

Orillon- A mass of earth, faced with stone, built on the shoulder of a casemate bastion, to cover the cannon of the retired flank...some are round and some are square...those which resemble the square orillon are best.¹⁰⁰

The Wyllis Redoubt epaulment is square, and is completely in conformance with Simes. Its nearly intact, well-preserved presence at the Wyllis Redoubt Detached Battery is particularly distinctive.

Redoubt 3, and its detached battery, also remains in an excellent state of preservation, principally because of its isolated and remote location. Redoubt 3 is located on a secondary knoll, in an area that was not particularly accessible either during the American Revolution, or today. Amateur archaeologists William Calver and Reginald Bolton working under the auspices of the New York Historical Society are known to have performed some of their quasi-archaeological excavations at Redoubt 3 in the early 1920's.¹⁰¹ With this exception, no other military or residential occupation or use; known excavations or other ground disturbance; or professional archaeology has been performed at this location. In the late fall of 2004 a pedestrian survey of Redoubt 3 and vicinity was performed by the author and USMA GIS team, accompanied by Mr. Don Wickham of Mount Independence State Historic Site, Vermont. A GPS receiver operated by Mr. Matthew Fletcher was used to document all above ground features. No subsurface testing was performed. Following the field survey, all recorded features were entered into the USMA Geographic Information System (GIS) system to permit spatial analysis to be performed. The results of this survey revealed the full extent of the overall military defensive and logistical complex, and soldier's encampment, that constituted Redoubt 3.

Redoubt 3 had been previously described as a pentagonal redoubt.¹⁰² Redoubt No. 3 was described by Arnold following his treason in September 1780: "Redoubt No. 3, a slight Wood Work, 3 feet thick, very Dry, no Bomb-Proofs, a single Abattis, the work easily set on fire. No cannon...."¹⁰³ However, when the perimeter of the redoubt was surveyed with GPS instruments, it was determined that the redoubt is actually hexagonal shaped [refer to GIS Figure 4]. The sides are not perfectly symmetrical. However, a hexagonal redoubt is particularly well suited to defend the terrain at this location, and the redoubt was not constructed symmetrically because different faces optimized musket fire along likely avenues of approach, as the GIS analysis subsequently revealed [refer to GIS Figure 5]. The six sides of the redoubt are 19 feet (east face), 15 feet and 28 feet on the northern two faces, the west face is 13 feet, and the two southern faces are 27 and 29 feet. This provides a total circumference of approximately 130 feet. Since no cannon were positioned directly within the redoubt, a garrison of 130 musket men would have necessary for this redoubt, exclusive of artillerymen at the detached battery.

A well-defined 4 ½ foot entrance appears to exist through the eastern side of the redoubt, which would be correctly positioned (away from the expected direction of British advance). This would suggest that the entrance was actually "five paces" wide, which would be in complete accordance with the recommended width for an entrance into a redoubt garrisoned only by infantry in accordance with Pleydell and Vauban.¹⁰⁴

¹⁰⁰ Captain Thomas Simes. *The Military Medley, Containing the Most Necessary Rules and Directions for Attaining a Competent Knowledge of the Art* (London: 1768).

¹⁰¹ W. L. Calver and R. P. Bolton, *History Written with Pick and Shovel* (New York: New York Historical Society, 1950).

¹⁰² Mead, *Archaeological Survey of Fort Putnam*, 53-57.

¹⁰³ Boynton, *History of West Point*, 114-115.

¹⁰⁴ Cubbison, "Historic Structures Report- Redoubt of West Point." 8.

INSERT GIS FIGURE 4

INSERT GIS FIGURE 5

Contemporary illustrations of redoubts are relatively rare, but two views of redoubts were also provided by Louis-Nicolas Van Blarenberghe's paintings "The Siege of Yorktown" and "The Taking of Yorktown" prepared for French King Louis XVI shortly following the conclusion of the War for American Independence (1786).¹⁰⁵ These two paintings clearly show square redoubts with an abatis, ditch, palisades in the ditch, fraising in the side of the redoubts, the redoubt parapets, and an entrance in the rear of the top redoubt. The top redoubt provides a view of the various components of a redoubt, while the bottom redoubt provides a soldier's perspective viewing the exterior of a redoubt. Additionally, the top redoubt view also depicts two redoubts to the left rear, and one redoubt to the right rear incorporated into the French and American siege lines, providing representative views of redoubts viewed from a distance.



Redoubts
From
Louis-Nicolas Van Blarenberghe's paintings
"The Siege of Yorktown" and "The Taking of Yorktown" (1786)

¹⁰⁵ Accessed on-line at <http://www.rouillac.com/blarenberghe-en.html> on January 13, 2005.

Two prominent stone stacks exist within the interior of the redoubt. The first prominent stone stack extends in two directions. The western portion of this stone stack is actually a relatively well-defined dry-stacked stone building foundation, approximately 20 feet by 11 feet. The eastern component of this stone stack is believed to have been from a collapsed chimney, again apparently manufactured of dry-stacked stone (no mortar could be identified, although it might have been a soft mortar that has subsequently eroded away). A particularly well preserved western facing hearth is located in the middle of the two stone stacks, and would have been placed at the eastern end of the structure. Based upon the excellent condition of this surviving hearth, this is interpreted as a guardhouse located within the redoubt, sufficient in size to house a small guard within the redoubt, as orders were stringent that the redoubts would be secured at nightfall. Orderly Books from the West Point garrison contain a number of entries regarding this:

October 11, 1780 – Guards at Redoubts 1, 2, 3, 4 as well as Wyllis Redoubt are to be constantly within the works night and day. Engineers will have small constructed magazines of planks for Redoubts 1,2,3,4. The temporary guard houses ordered by Genl St. Claire are also to be completed as soon as may be.¹⁰⁶

October 19, 1780 – All guards posted at works are to be within them at retreat beating and the gates to be shut and secured till sunrise.¹⁰⁷

October 7, 1780 – The officers of the advanced redoubts are constantly to shut those gates on the beating of retreat and never suffer them to be opened after the tattoo until it is fare day light.¹⁰⁸

This is also consistent with a September 1779 Inspection Report of Chief Engineer Duportail in which he noted, “The barracks for these three places [Redoubts 1, 2 and 3] will be made, as near as possible... If we can work this winter at the bomb proof of this redoubt, we shall be obliged to make the barracks without, except for a covering for a subalterns guard within during the night.”¹⁰⁹ Although information on the precise size of the Redoubt 3 guard force is unknown, West Point Orderly Books recount the assignment of the Redoubt 2 guard force on two locations:

June 23rd 1780 – Lieut Benscoten with A party of one Serjt one Corpl and 15 privates is to be Detacht this Morning to No. 2 of which post or Redoubt he is to take possession....

July 21st 1780 – one Serjt & Six privates are to Remain at the Redoubt No. 2 under the Direction of Ensign Woodruff and for the future are to be Releived Every forth Day for Which time the next relief will Draw Provisions before they march up.¹¹⁰

The size of this structure, estimated from the remnants of the stone stack, supports a guardhouse of a sufficient size to house a relatively small guard force. This guardhouse was apparently also used to store some limited provisions, for an inspection in April 1782 reported one barrel of beef, “bad” at Redoubt 3.¹¹¹

¹⁰⁶ “Orderly Book, West Point Garrison, October-November 1780” WPA Transcript, Special Collections and Archives, U.S. Military Academy Library, West Point, New York, 12-13.

¹⁰⁷ Ibid., 22.

¹⁰⁸ “Benjamin Peabody Orderly Book” WPA Transcript, Special Collections and Archives, U.S. Military Academy Library, West Point, New York, 75-76.

¹⁰⁹ Louis le Beque du Portail to General George Washington, “Defense of West Point,” September 24, 1779. George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 27, 2004.

¹¹⁰ Almon W. Lauber, Editor. *Orderly Books of The Fourth New York Regiment, 1778-1780, the Second New York Regiment 1780-1783 by Samuel Tallmadge and Others with Diaries of Samuel Tallmade, 1780-1782 and John Barr, 1779-1782* (Albany: The University of the State of New York, 1932), 376-377, 419-420.

The second stone stack has been interpreted as a small powder magazine for the redoubt. This stone stack is much less well defined than the guardhouse, and an estimate of the size could not be made. It would have been relatively small. Another inspection of West Point performed by West Point Chief Engineer Villefranche in April 1782 recommended for Redoubt 3: "There ought to be a bomb proof, a Magazine for powder, one for provisions, and Barracks for the garrison."¹¹² Archaeological investigations would be necessary to confirm the use of these two structures.

To the west of the redoubt are the remnants of the parapets for an artillery battery. Another of the interminable French engineers serving with the Continental Army, Jean B. Gouvion, would note of Redoubt 3 in November 1780: "The Redoubt Number 3 is finished and wants two batteries; one of them is already begun but can't be complete this fall for want of hands."¹¹³ Villefranche would note of this battery in April 1782, "The battery nearly begun must be finished, and another established to defend the Valley toward the north."¹¹⁴ Although no evidence could be located through extensive pedestrian surveys of the presence of another battery at Redoubt 3, this report clearly indicates that one artillery battery had been constructed at Redoubt 3. Neither the 1779 and 1780 ordnance returns list any artillery pieces actually present at Redoubt 3, but an August 1779 inspection of West Point recommended that five 6-pounders be located at this redoubt.¹¹⁵ An artillery battery was proposed for here as early as 1779, construction was initiated in 1780, and the battery was still considered to be not finished as late as the spring of 1782. The remnants of this battery are similar to those at Marine Battery on Constitution Island. The battery is clearly detached from the redoubt, similar to the other batteries at Redoubt 1 and 2, and Wyllis Redoubt. The parapet walls are dry-laid stone, approximately six to seven feet in width, and the surviving walls are six to eight feet high. Some of the dry-laid stone work is in particularly excellent condition. The fact that the parapet walls of both the redoubt and battery are dry-laid stone clearly indicates that the redoubt was considerably strengthened following Arnold's treason in September 1780. Parapet walls of this thickness would have been proof against field artillery such as 6-pounders or 9-pounders, but would not have been strong enough to have resisted heavier siege artillery (such as 12-pounders or larger cannon). Sufficient length exists to support the presence of five 6-pounder cannon along the battery wall, if constructed as per Muller and LeBlond. To the rear of the main parapet walls are poorly defined remnants of dry-laid stone platforms, believed to be similar to the firing platform supports that survive at the detached battery of Redoubt Wyllis. The rear stone wall, which is quite prominent, provides an estimated depth for the firing platform of 22 feet, slightly shorter than the firing platform for the Detached Battery of Redoubt Wyllis, but still longer than firing platforms as recommended by Muller and LeBlond, suggesting the use of the interior spaces as small ammunition magazine(s) as per Redoubt Wyllis. No embrasures are discernable. The apparent firing direction is into Stony Lonesome Valley and Bare Rock Mountain, interlocking with the defensive fires from Redoubts 1 and 2. The battery contains a well-defined parapet to the right (western) flank, that is, the flank most exposed to a possible British attack. Stone walls were also noted on the left (eastern) flank that appears to provide a covered way (protected communications path) between the detached battery and the redoubt itself.

¹¹¹ West Point, New York Inspection Committee to General George Washington, "Report and Return," April 20, 1782. George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 27, 2004.

¹¹² Chevalier de Villefranche to General George Washington, "Estimate and Report on Repair Work," April 15, 1782. George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 29, 2004.

¹¹³ Jean B. Gouvion to General George Washington, "West Point, New York, Works," November 2, 1780. George Washington Papers at the Library of Congress, Series 4: General Correspondence, 1697-1799, Library of Congress, Washington, D.C., accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html> on December 29, 2004.

¹¹⁴ Villefranche, "Estimate and Repair on Repair Work," April 15, 1782, Washington Papers.

¹¹⁵ McDougall, Knox, and du Portail, "Estimate of Cannon Necessary to Defend West Point, New York," August 20, 1779, Washington Papers.

To the exterior (southwest) of the right (western) corner of the artillery battery is a roughly square, crudely constructed stone structure. Although this structure mystified Mead in his 1968 survey, the author believes this to have been a simple deer blind constructed by a hunter from parapet stones at some point in the past, and thus has no historic significance.¹¹⁶ This structure is quite crudely constructed, apparently without any masonry skills, is not symmetrical, and is not in conformance with any other known military construction dating from this period at West Point, Constitution Island, or other historic sites visited during the preparation of this report (including Fort Ticonderoga, Mount Independence, Yorktown, Valley Forge, Fort Montgomery and Clinton).

A slight stone wall is barely discernable down slope from the artillery battery's parapet. Mead surmised that this wall could have supported a "palisade or fraise." Although this could not be fraising since such a defensive measure would have been incorporated directly into the walls of a redoubt, and could not have been effectively used in an artillery battery, it is entirely possible that this is the remnants of a defensive palisade. If true, this might constitute the only surviving trace of palisades for any of the West Point fortifications. Archaeological explorations would be necessary to confirm the presence of palisades at this redoubt. The use of stones to support a palisade would be a distinctive military engineering approach, if validated.

A series of particularly interesting resources exist to the east (or defensive rear) of the redoubt [refer to GIS Figure 6]. The remnants of the Revolutionary War road still survive immediately to the east of Redoubt 3. This road trace appears to conclude in a poorly defined circular terminus at a rock shelf at approximately waist (or wagon top) height. The author has interpreted this as a field expedient loading dock. A wagon could easily have pulled up to this rock, which would have facilitated unloading supplies or equipment directly from the wagon to the rock. From this rock two well-defined foot paths were observed. One foot path leads nearly due west up a set of natural rock stairs, directly to the entrance into Redoubt 3. The other leads directly to a square structure located to the northeast of the redoubt. This structure, protected by intervening terrain from direct musket or artillery fire, could have served as a storehouse or barracks. This structure consists of the well-defined dry-laid stone foundation of a square building, approximately 24 feet by 18 feet. Its location outside of the redoubt makes it unlikely that this would have been a powder magazine. Again, archaeological excavations would be necessary to confirm the use of this structure.

Also discernable are eight very well defined tent pads or hut sites, forming a roughly pentagonal alignment to the east (defensive) rear of the redoubt. This is believed to be an encampment for the redoubt garrison, or the soldiers stationed here to construct the redoubt. Several of the better defined features are likely excavations performed by Calver and Bolton in the early 1920s. However, the surface recovery of a barrel hoop in the Redoubt 3 campsite vicinity during the pedestrian survey constitutes strong evidence that additional archaeological resources survive at Redoubt 3. The well-defined hut sites appear to suggest the presence of a campsite laid out in conformance with other known military campsites, and in conformance with contemporary military treatises on castrametation (military encampments). It is surmised that the headquarters tent or hut of the commanding officer would have occupied the topographically prominent terrain to the west, with subordinate officers extending downhill, and the company streets of the command occupying the relatively flat plateau to the east.¹¹⁷

¹¹⁶ Mead, *Archaeological Survey of Fort Putnam*, 55.

¹¹⁷ For this, refer to a series of articles by John U. Rees, "We...got ourselves cleverly settled for the night...' Soldier's Shelter on Campaign during the War for Independence" *Military Collector & Historian*; and Lewis Lochee, *An Essay on Castrametation* (London: 1778).

INSERT GIS FIGURE 6



**Barrel Hoop, Twisted into Crude Hook,
Recovered from Redoubt 3 during Pedestrian Survey (Surface Collection)**

The excellent state of preservation at the Redoubt 3 complex was combined with a careful pedestrian survey, using modern surveying equipment, and the results were then analyzed using GIS. The use of pedestrian surveys when combined with GPS and GIS technology have demonstrated that these resources provide archaeologists and historians with a new tool to more effectively analyze spatial use of military positions, both tactically, and logistically. This investigation has revealed that a complete military complex remains for future study and analysis at this site, making it quite possibly the most significant surviving feature of the American Revolution at West Point. It is hoped that future archaeological efforts can yield additional information on the occupation and utilization of the Redoubt 3 knoll.

3.3 Fortress West Point - Overall Defensive Configuration

It is of particular interest that the protection of these river differences, which were all focused directly upon preventing ships from proceeding north up the Hudson River, was an integral component of the West Point fortress. In order to safeguard the vulnerable flanks and rear of these river batteries, Kosciusko constructed a series of defensive positions on the river bluff and other pieces of high ground directly in conformance with military treatises of the time.¹¹⁸ Ozanam, again, begins the discussion:

How to Fortify a Place Commanded by Some Rising Ground- You must fortify yourself against those commanding grounds by epaulments, or earthen parapets, to cover yourself...they must be fortified with tenaills, little forts, crowns or horns.

How to Fortify Towns Situated Upon High Places - Those places of the hill which the enemy might make lodgements in, must be fortified with bonnettes, which are works of earth made like a ravelin, called also fleches, they have no ditch, but only a parapet 3 feet high, bordered with a palisades and that its access may be harder to the besiegers, you must add another palisade 10 or 12 paces beyond the first and about 3 or 4 feet out of the ground.¹¹⁹

Another early work by the previously referenced Earl of Orrery in 1677 supported Ozanam:

Lastly, if there be any eminencies of ground near your standing camp, and yet without your line that invirons it, you must secure these heights, not only by making redoubts or forts on the tops of them, but also by making a line, if you have men enough to do it, round about the foot of those heights, and you must make covered ways from your camp to those redoubts or forts, the more safely to relieve them.¹²⁰

¹¹⁸ For more on this, refer to Cubbison, *The Redoubts of West Point*.

¹¹⁹ Ozanam, *A Treatise of Fortifications*, 146, 148.

¹²⁰ Roger, Earl of Orrery, *A Treatise on the Art of War*, 121-123.

Tielke similarly noted:

It frequently happens that a good position may be taken, notwithstanding there are one or more heights in the front, which may be favorable to the enemy if taken, in that case they ought to be well intrenched, and defended by grenadiers or other picked troops, with an abundant supply of cannon.¹²¹

Muller's classic *Treatise*, known to have been utilized by both Washington and Knox, stated:

Building a Fortress - When a fort lies so near the water, care must be taken that the enemy may not land in their boats, or storm it by land, to obstruct which, redoubts or batteries must be built, to resist both in front and in flank, and if they can land anywhere beyond the reach of cannon, these redoubts or batteries must be fortified all round with a wall and good ditch, that they may not be surprised in the rear.

How to Make the Plan of a Fortress - ...the works should flank or defend each other in the most direct manner possible. If there are any hills or rising grounds that command some of the works, little forts or redoubts should be made there, with a secure communication to the fortress. In short, engineers should be sparing in their works, to make no more than what are barely necessary.¹²²

Guillaume LeBlond, in another translation of his extensive works on a wide and diverse range of military topics, responded to questions regarding the establishment of fortifications:

Q: "What is the most essential defense of a fortification?"

A: "It is the defense in flank."

Q: "What are the maxims or principles in fortification?"

A: "1st that there be no post or part of an inclosure which is not seen and defended by some other post or part of the same inclosure."

Q: "Are there not works beyond the ditch to increase the means of defense?"

A: "Yes, these are called outer-works, and increase the strength of the plan, because the enemy must become master of them before the place can be carried. They serve to cover bridges, weak places, to inclose suburbs, to join a city to eminences which command it."

Q: "What is the principle upon which these works are constructed and situated?"

A: "...That none of their parts be unprotected, either by the body of the place, or by parts of the outer works, or by some other neighboring out-works by which they may be flanked."¹²³

The famous French military commander, the Marshall Maurice de Saxe, would certainly have concurred with the West Point defensive scenario:

That it is much more advantageous for a sovereign to establish his places of arms, in places strengthened by nature, and proper to cover a country, than to fortify town at immense expense, or to increase those already built.

Places may be found so fortified by nature, that it is almost impossible to invest them, and which can be attacked in one part only, which with very little expense, may be rendered almost impregnable, for I look on nature to be infinitely more strong than art.

Let us first examine the use of a fortress. It is to cover a country, to oblige an enemy to attack it before they can pass it, to secure a retreat for one's troops, there to lodge them in safety, there to form magazines, and there to lay up in stores the artillery, ammunition, etc. during the winter.¹²⁴

¹²¹ Tielke, *The Field Engineer*, 127.

¹²² Muller, *A Treatise Containing the Practical Art of a Fortification*, 124, 130, 133.

¹²³ Guillaume LeBlond, *The Elements of Fortification*, Translated from the French by Jonathan Williams. (Philadelphia; Printed for the War Office by C.P. Ward, 1801), 14, 17, 25.

Of all the varieties of war, the defense of entrenchments seems to me to be the most difficult. I do not have much faith in the best. As far as I am concerned, I do not believe in constructing them. Redoubts are my favorite works.... Every soldier knows the difficulty of taking a good redoubt. It requires a special formation with several battalions and fifteen or twenty companies of grenadiers in order to attack on several sides at the same time, and even then success is uncertain. These redoubts are also the more advantageous in that they require but little time for their construction and are useful in an infinity of situations. A single one is frequently sufficient to stop a whole army in a terrain corridor. They can be used to prevent your being harassed on a critical march, to support one of your wings, to divide a piece of ground, to occupy a large space when there are not enough troops to support a flank on a wood, a marsh, a river, etc.¹²⁵

Works by the Marshall Saxe were utilized by Washington, and were also highly recommended by Henry Knox.¹²⁶

As finally established by Kosciusko, the defensive configuration at West Point was based around the Hudson River defenses (the chain and boom, four critical river batteries, and Fort Arnold). In turn, the protection of the Hudson River defenses was centered around Fort Arnold (Fort Clinton) on the West Point side, and the three redoubts (Redoubts 5, 6 and 7) on the Constitution Island side. Fort Arnold was a major fortification heavily armed with artillery, and presumably capable of withstanding any attack except that of a deliberate siege. The three redoubts on Constitution Island, all oriented to the east, were placed on prominent knolls that controlled all approaches to the island from its rear. Given the presence of the Constitution Island marsh that naturally provided a defensive ditch, these redoubts should have been sufficient to defend against the size of a force that the British would have been able to employ given the difficulties of traversing this swamp. To defend Fort Arnold in turn were a number of works, extending from South Battery to Fort Putnam to Sherburne's Redoubt. Fort Putnam in particular was placed on prominent terrain that commanded both Fort Arnold and The Plain, and its commanding position protected Fort Arnold from any attack from the west. Sherburne's Redoubt defended against a British flanking attack from the north; and South Battery defended against a British land force directly attacking along the west bank of the Hudson River. Water Battery was probably nothing more than an advanced guard post for the four more important river batteries to its north, as intervening terrain prevented these four batteries from observation south or down the river. Fort Putnam was also a major defensive position possessing natural topographical advantages strengthened by fortifications and a substantial armament of artillery (five 18-pounders, two 12-pounders, one 4-pounder, and four Royal or 5 ½" howitzers in September 1780). Presumably, Fort Putnam would also be defensible against anything but a deliberate siege approach. The best land approach to Fort Putnam was along the ridge extending from Fort Putnam to the south (today's Lusk Family Housing ridge). During the American Revolution Lusk Reservoir did not exist, but the Lusk Reservoir and Michie Stadium area was swampy and marshy, and could not be easily traversed or used for siege operations. To the west of Fort Putnam are numerous cliffs, and rocky terrain, that did not lend to siege operations. To defend the Lusk Housing ridge from a British approach, a series of strong outer works were constructed along this ridge. The closest to Fort Putnam was Redoubt Webb, with Redoubt Wyllis and additional works further to the south, with the southern terminus of the ridge defended by Battery Miegs and its supporting works. Any British approach along this ridge would have to reduce this series of positions before siege operations against Fort Putnam could be initiated.

¹²⁴ Captain Charles Vallancey, 10th Foot, Translator, *An Essay on Fortification; or an Enquiry into the causes of the great superiority of the attack over the Defence and With a Supplement Containing Marshall Saxe's New System of Fortification and Construction of Wooden Forts, Extracted from his Memoirs on the Art of War* (Dublin: Richard James, 1757), 115, 116-117, 120. This exact book appears in the catalogue of Washington's Library. Lane, *A Catalogue of the Washington Collection*, 539.

¹²⁵ Marshal Maurice de Saxe, translated by Brigadier General Thomas R. Phillips, *Reveries on the Art of War* (1732; translated edition Harrisburg, Pennsylvania: The Military Service Publishing Company, 1944), 110, 112-113, 114-115.

¹²⁶ Lane, *A Catalogue of the Washington Collection*, 539; and Riling, *The Art and Science of War in America*, 11. Additionally, refer to Colonel Oliver L. Spaulding, Jr. "The Military Studies of George Washington" *The American Historical Review* XXIX, No. 4 (July 1924), 680.

As American military commanders and their various supporting Engineering officers evaluated the terrain around the bend of the Hudson River at West Point, it became immediately obvious that West Point was controlled by ground that continually ascended nearly twenty miles to the west (essentially to Schunnemunk Mountain immediately west of Woodbury Creek). Obviously, it would be impossible to construct defenses to secure all of this ascending ground, nor would the Continental Army ever be strong enough to control such a geographically large area. To command the ascending ground immediately above and around Fort Putnam, Kosciuszko designed and had constructed a string of four redoubts (Redoubt No. 1, 2, 3 and 4). These redoubts were intended to be strong enough to withstand a simple infantry assault, and would require a deliberate attack before they could be captured. They were intended to provide perimeter security for Fort Putnam. Presumably, these redoubts could put up a stout enough defense to enable Fort Putnam and Fort Arnold to be placed into a condition capable of requiring any British approach to be a formal siege operation. Siege operations were tedious, time consuming and difficult to supply. The overall American defensive strategy was that the American field army could be deployed to West Point to counterattack any British attacking force, which would be focused upon its siege operations, and thus be forced to fight upon conditions imposed by the American army's maneuvers.

Finally, among the most important aspects of Fortress West Point is that all of the myriad batteries, redoubts, forts, and other defensive measures such as the chain and boom were positioned so that they could provide interlocking fires to more effectively control terrain. All the various positions of Fortress West Point were positioned to provide interlocking fields of fire, to control the terrain around and between them with artillery fire; and all the redoubts were positioned to control militarily key terrain with musketry fire. This permitted the Americans to control all of the area immediately around the river defenses with a minimum force, through making the use of smaller defensive works such as redoubts and detached batteries, rather than requiring elaborate and more extensive fortifications. Although performing a complete terrain analysis of Fortress West Point is beyond the intent of this study, GIS capabilities were utilized to evaluate one representative example of this design feature. Redoubts 1, 2 and 3 were sited on commanding knolls to the southwest of Fort Putnam, to control ascending ground around this major fortification. To the south-southwest of Redoubts 1 and 2 is Bare Rock Mountain, a promontory whose elevation commanded these three redoubts. A British force advancing by land could theoretically seize Bare Rock Mountain, which was located beyond the extent of the American defensive perimeter. Much as the British had occupied Sugar Loaf Mountain (known today as Mount Defiance) above Fort Ticonderoga in 1777, a British artillery battery at Bare Rock Mountain would have made these three redoubts untenable, and forced their hasty evacuation. To preclude this eventuality, four artillery batteries were constructed. One detached battery was constructed several hundred yards to the southeast of Redoubt 1, and three detached batteries were constructed immediately adjacent to Redoubts 1, 2 and 3. These four batteries were positioned such that artillery fire from these positions could place effective flanking fire upon Bare Rock Mountain, thus making any British occupation or use of this elevation problematic. Additionally, the guns from the Redoubt 3 battery were positioned to place artillery fire across Stony Lonesome Valley, preventing a British force from advancing up this ground to avoid the American redoubts. GIS Figure 7 graphically depicts the effective use of interlocking artillery fire from these four batteries.

Fortress West Point comprised a defensive scenario completely in accordance with the previously referenced, well established tenets of mid 18th century military art and science.

INSERT GIS FIGURE 7

4.0 Conclusions

The great significance of Fortress West Point is that it was constructed on an already naturally strong position in such a manner that it enabled the American military command to defend the Hudson River corridor with a comparatively small force (what modern military tacticians refer to as “Economy of Force”). On several occasions during the War for American Independence the natural topographical strength of West Point, enhanced by the layers of military fortifications, permitted Washington to successfully defend the Hudson Valley corridor with a minimum expenditure of manpower (including usually unreliable militia) while still being able to aggressively maneuver his main field force from the Continental Army- in 1778 against the British garrison of Rhode Island; in 1779 against Native Americans supporting the British cause in western New York, and most significantly in 1781 against the British Army of Lord Cornwallis in Virginia. The use of West Point in this manner was entirely consistent with military art and science as practiced during the era of the American Revolution.

The American defensive position was anchored on the chain and boom across the Hudson River, defended by four well-sighted artillery batteries, which in turn were defended by an interlocking series of fortified positions occupying key terrain. The use of the chain and boom, the design and construction of the river artillery batteries guarding it, and the positioning of Fort Arnold, Fort Putnam, and the numerous redoubts controlling the ground around West Point were all based upon existing military engineering treatises of the 18th century. These defensive positions were derived from previous American experiences with similar military fortifications during the Seven Years Wars; from previous river defense successes (such as the Fort Ticonderoga-Mount Independence defense in 1776 and the Delaware River defense in 1777); and from previous river defense failures (such as the Hudson River defense in 1776-1777 and Fort Ticonderoga in 1777). Kosciusko and other engineers and officers designed a formidable string of interlocking fortifications that effectively controlled critical terrain around the river defenses. The great success of these works is that the efficient use of redoubts and batteries enabled the American garrison to fully command West Point, without becoming over-extended as had happened at Fort Montgomery and Fort Clinton. The American field force was never large, and had West Point been incorrectly designed and fortified, the entire American Continental Army would have been tied to the Hudson Highlands. The great significance of West Point was that it enabled Washington to negate the strategic British position at New York City, while freeing his field army to perform the operational and strategic evolutions that would eventually secure American Independence at Yorktown in 1781.

Acknowledgements

The author wishes to acknowledge the generous assistance of his friend, Mr. Christian Cameron, PhD Candidate in Ancient History at the University of Toronto, Toronto, Canada, with research on defensive chains and booms during antiquity.

The Special Collections and Inter-Library Loan Staff of the USMA Library made regular and significant contributions to facilitating the research component of this study.

Mr. Don Wickham of Mount Independence Historic Site, Vermont also assisted the author and GIS team with a pedestrian survey of Redoubt No. 3, and his insights were important in evaluating the overall military and logistical complex.

Bibliography – Redoubts and River Defenses of Fortress West Point

Contemporary Military Manuals

Crusso, John. *Castrametation, or the Measuring Out of the Quarters for the Encamping of an Army* (London: 1642).

De Clairac, Chevalier, translated by John Muller. *The Field Engineer of M. le Chevalier de Clairac, from the French*. London: J. Millan, 1773.

DeSauguliers, J.T., Translator. *A Treatise of Fortifications Containing the Ancient and Modern Method of the Construction and Defense of Places and the Manner of Carrying Sieges, Written Originally in French by Monsieur Ozanam, Professor of Mathematics at Paris*. London: J. Jackson & J. Worrall, 1727.

Fortune, T.A. *The Artillerist's Companion, Containing the Discipline, Returns, Reports, Pay, Provision, &c. of that Corps in Field, In Forts, At Sea, Etc*. London: J. Millan, 1778; reprint edition Bloomfield, Ontario and Alexandria Bay, New York: Museum Restoration Service, 1992.

LeBlond, Guillaume. *The Elements of Fortification, Translated from the French*. Philadelphia: Printed for the War Office by C.P. Wayne, 1801.

LeBlond, Guillaume. *A Treatise on Artillery*. London: E. Cave, 1746; reprint edition Ottawa, Ontario: Museum Restoration Service, 1970.

LeCointe, Jean Louis. *The Science of Military Posts; For the use of Regimental Officers, who Frequently Command Detached Parties, In which is Shown the Manner of Attacking and Defending Posts, With Cuts, Explaining the Construction of Field-Forts and Intrenchments*. London: Printed for T. Payne, at the Mews Gate, 1761.

Lochee, Lewis. *An Essay on Castrametation*. London: 1778.

Lochee, Lewis. *Elements of Field Fortification*. London: T. Cadell and T. Egerton, 1783.

Muller, John. *A Treatise Containing the Elementary Part of Fortification, Regular and Irregular*. London: J. Nourse, 1746.

Muller, John. *A Treatise Containing The Practical Art of a Fortification, In Four Parts*. London: J. Millan, 1755.

Muller, John. *A Treatise of Artillery*. 1757; revised edition London: John Millan, 1780 reprinted by Alexandria Bay, New York and Bloomfield, Ontario, Canada: Museum Restoration Service, 1977.

Muller, John. *The Attac and Defense of Fortified Places*. 2nd Edition, 1757: Revised Edition Arlington, Virginia: Flower-de-Luce Books, Invisible College Press, 2004.

Pleydell, Lieutenant J.C. *An Essay on Field Fortification: Intended Principally for the use of Officers of Infantry, showing how to trace out on the ground and construct in the easiest manner, all sorts of Redoubts and other field works, translated from the original manuscript of an officer of experience in the Prussian Service*. London: Printed for J. Nourse, Bookseller to His Majesty; 1768; New Edition, London: Printed for F. Wingrave, 1790.

Roger, Earl of Orrery. *A Treatise on the Art of War*. Savoy: Henry Herringman, 1677.

Rudyard, Charles W. *Course of Artillery at the Royal Military Academy, As Established by His Grace, The Duke of Richmond, Master General of his Majesty's Ordnance*. Woolwich: Royal Military Academy, 1793.

Saxe, Marshal Maurice de, translated by Brigadier General Thomas R. Phillips. *Reveries on the Art of War*. 1732; translated edition Harrisburg, Pennsylvania: The Military Service Publishing Company, 1944.

Simes, Captain Thomas. *The Military Medley, Containing the Most Necessary Rules and Directions for Attaining a Competent Knowledge of the Art*. London: 1768.

Tielke, Captain J.G., translated by Ensign Edwin Hewgill. *The Field Engineer, or Introduction Upon Every Branch of Field Fortifications*. 2 volumes. 1769; revised edition London: J. Walter, 1789.

Vallancey, Captain Charles, 10th Foot, Translator. *An Essay on Fortification; or an Enquiry into the causes of the great superiority of the attack over the Defence and With a Supplement Containing Marshall Saxe's New System of Fortification and Construction of Wooden Forts, Extracted from his Memoirs on the Art of War*. Dublin: Richard James, 1757.

Vauban, Sebastian LePrestre de, translated by George A. Rothrock. *A Manual of Siegecraft and Fortification*. 1740; reprint edition Ann Arbor: University of Michigan Press, 1968.

Vauban, Marchel Sebastian le Prestre de. *The New Method of Fortification, published in English by Abel Swall, London, 1691*. Ann Arbor, Michigan: University Microfilms, Inc, 1963.

Young, Sir James. *An Essay on the Command of Small Detachments*. London: 1766.

Primary Sources

Baldwin, Jeduthan. "Diary of Colonel Jeduthan Baldwin" *The Bulletin of the Fort Ticonderoga Museum (BFTM)* IV, No. 6 (January 1938).

Baldwin, Thomas Williams, Editor. *The Revolutionary Journal of Colonel Jeduthan Baldwin, 1775-1778*. Bangor: Printed for the DeBurians, 1906.

Bayley, Joseph. "Capt. Jacob Bayley's Journal" in Frederick P. Wells, *History of Newbury, Vermont* (St. Johnsbury, Vermont: The Caledonian Company, 1902).

"Benjamin Peabody Orderly Book." WPA Transcript, Special Collections and Archives, U.S. Military Academy Library, West Point, New York.

Bloodgood, Simeon DeWitt. *The Sexagenary; or Reminiscences of the American Revolution*. Albany: Joel Munsell, 1866.

Buell, Rowena, Editor. *The Memoirs of Rufus Putnam and Certain Official Papers and Correspondence*. Boston and New York: Houghton, Mifflin and Company, 1903.

Calef, Colonel John H. Editor. "Extracts from the Diary of a Revolutionary Patriot." *Journal of the Military Service Institution of the United States* 39 (July-August 1906), 123-130.

Cohn, Arthur. *The Great Bridge, "From Ticonderoga to Independant Point."* Lake Champlain Management Conference, Publication Series, Demonstration Report No. 4, May 1995.

DuCoudray. "Du Coudray's Observations on the Forts Intended for the Defense of the Two Passages of the River Delaware, July 1777." *Pennsylvania Magazine of History and Biography* XXIV, No. 3 (1900), 343-347.

Elmer, Ebenezer. "Journal Kept During An Expedition to Canada in 1776 by Ebenezer Elmer." *Proceedings of the New Jersey Historical Society* II, No. 4 (1847).

Gates, Horatio. Papers. Microfilm copy at Library, U.S. Military Academy, West Point, New York.

George Washington Papers. Library of Congress, Washington, D.C. Accessed on-line at <http://lcweb2.loc.gov/ammem/gwhtml/gwhome.html>.

Hall, Charles S. Hall. *Life and Letters of Samuel Holdon Parsons*. Binghamton, New York: Otsenigo Publishing Company, 1905.

Lamb, Sergeant Roger. *An Original and Authentic Journal of Occurrences During the Late American War, From Its Commencement to the Year 1783*. 1809; reprint edition New York: Arno Press, 1968.

Lauber, Almon W., Editor. *Orderly Books of The Fourth New York Regiment, 1778-1780, the Second New York Regiment 1780-1783 by Samuel Tallmadge and Others with Diaries of Samuel Tallmade, 1780-1782 and John Barr, 1779-1782*. Albany: The University of the State of New York, 1932.

"Orderly Book, West Point Garrison, July-August 1779 and August- December 1779." WPA Transcript, Special Collections and Archives, U.S. Military Academy Library, West Point, New York.

"Orderly Book, West Point Garrison, October-November 1780." WPA Transcript, Special Collections and Archives, U.S. Military Academy Library, West Point, New York.

Proceedings of a General Court Martial for the Trial of Major General St. Clair, August 25, 1778" (Philadelphia: Hall and Sellers, 1778); in *Collections of the New York Historical Society for the Year 1880* (New York: 1881).

Sizer, Theodore, Editor. *The Autobiography of Colonel John Trumbull, Patriot-Artist, 1756-1843*. 1841: reprint edition New Haven: Yale University Press, 1953.

St. Clair, Brigadier General Arthur. Letter to Unknown, October 25, 1776. Fort Ticonderoga Museum, Ticonderoga, New York.

Todish, Timothy J., Editor, and Gary S. Zaboly, Illustrator. *The Annotated and Illustrated Journals of Major Robert Rogers*. Fleischmanns, New York: Purple Mountain Press, 2002.

Tuttle, Timothy. "Journal of Sergeant Timothy Tuttle, 1st New Jersey Regiment, 1775-1776." New Jersey Historical Society, Newark, New Jersey.

Webster, J. Clarence, Editor. *The Journal of Jeffery Amherst, Recording the Military Career of General Amherst in America from 1758 to 1763*. Chicago: University of Chicago Press, 1931.

Wintersmith, Lieutenant Charles, Assistant Engineer. "Plan of Ticonderoga and Mount Hope, 1777." Ticonderoga, New York: Fort Ticonderoga Museum.

Secondary Sources

Bellico, Russell P. *Sails and Steam in the Mountains, A Maritime and Military History of Lake George and Lake Champlain*. Fleischmanns, New York: Purple Mountain Press, 1992.

Bellico, Russell P. *Chronicles of Lake Champlain, Journeys in War and Peace*. Fleischmanns, New York: Purple Mountain Press, 1999.

Bradley, Lieutenant Colonel John H. *West Point and the Hudson Highlands in the American Revolution*. West Point, New York: U.S. Military Academy, 1976.

- Bolton, Reginald P. *Fort Washington, An Account of the Identification of the Site...with a History of the Defense and Reduction of Mount Washington*. New York: Empire State Society of The Sons of the American Revolution, 1902.
- Boynton, Edward C. *History of West Point and Its Military Importance During the American Revolution*. New York: D. Van Nostrand, 1863.
- Brackendridge, Hugh M. "The Siege of Fort Mifflin." *Pennsylvania Magazine of History and Biography* XI, No. 1 (1887), 82-88.
- Bradford, Ernle. *The Great Siege*. New York: Harcourt, Brace & World, Inc., 1961.
- Calver, W. L. and R. P. Bolton. *History Written with Pick and Shovel*. New York: New York Historical Society, 1950.
- Campbell, J. Duncan. "Investigations at the French Village, Fort Ticonderoga, New York, 13 June – 15 July 1957." *The Bulletin of the Fort Ticonderoga Museum* X, no. 2 (1958), 143-155.
- Caples, Lieutenant Colonel William Goff. "George Washington's Military Guide." *The Military Engineer* XIX, No. 105 (1927), 244-247.
- Carr, William H. and Richard J. Koke. "Twin Forts of the Popolopen," *Forts Clinton and Montgomery, New York, 1775-1777*. Bear Mountain, New York: Bear Mountain Trailside Museums, Historical Bulletin No. 1, July 1937.
- Caruana, Adrian B. *British Artillery Ammunition, 1780*. Bloomfield, Ontario, Canada: Museum Restoration Service, 1979.
- Caruana, Adrian B. "John Muller's Treatise on Artillery." *Arms Collecting* 19, no. 2 (1981), 50-56.
- Charbonneau, Andre. *The Fortifications of Isle Aux Noix*. Ottawa, Canada: Studies in Archaeology, Architecture and History, Parks Canada, 1994.
- Crozier, Dr. Daniel G., et. al. *Revolutionary War Fortifications, West Point, New York: The Archaeological Investigation and Stabilization of Redoubt No. 4*. Philadelphia, Pennsylvania: Department of Anthropology, Temple University, 1976.
- Cubbison, Douglas R. *Historic Structures Report, The Redoubts of West Point*. West Point, New York: Directorate of Housing and Public Works, U.S. Military Academy, January 2004.
- Deary, William P. "Defending the Hudson River, 1776-1777: Defending the Lower Hudson in 1776" *Sea History* 98 (Autumn 2001), 7-10.
- Diamant, Lincoln. *Bernard Romans, Forgotten Patriot of the American Revolution*. Harrison, New York: Harbor Hill Books, 1985.
- Diamant, Lincoln. *Chaining the Hudson, The Fight for the River in the American Revolution*. New York: Lyle Stuart Book, 1989.
- Elmer, Albert C. "A Glimpse Into the Past at Fort Carillon." *The Bulletin of the Fort Ticonderoga Museum* IX, No. 2 (Winter 1953), 115-136.
- Feiser, Louis M. and Paul R. Huey. "Archaeological Testing at Fort Gage, A Provincial Redoubt of 1758 at Lake George, New York." *The Bulletin & Journal of Archaeology for New York State* 90 (1985), 40- 59.

Fisher, Charles L. *"Obliged to live...on the outside of the Fort": A Report on the Soldier's Huts Found During Archaeological Survey of the Proposed Maintenance Building Site, Crown Point State Historic Site, Essex County, New York.* Waterford, New York: Bureau of Historic Sites, New York State Office of Parks, Recreation and Historic Preservation, February 1993.

Fisher, Charles L., Editor. *"The Most Advantageous Situation in the Highlands," An Archaeological Study of Fort Montgomery Historic Site.* Albany, New York: New York State Museum, 2004.

Frost, Robert I. *The Northern Wars, 1558-1721.* Essex, England: Pearson Education Limited, 2000.

Hamilton, Edward P. *Fort Ticonderoga, Key to a Continent.* 1964; reprint edition Fort Ticonderoga, New York: 1995.

Historic Structures Inventory United States Military Academy West Point New York. 4 volumes. Washington DC: Historic American Building Survey Historic American Engineering Record, U.S. Department of the Interior, National Park Service, 1984.

Hitsman, Mackay and C.C. J. Bond. "The Assault Landing at Louisburg, 1758." *The Canadian Historical Review* XXXV, No. 4 (December 1954), 314-330.

Huey, Paul R. "A Brief Overview and Interpretation of the Fort Gage Excavations at Lake George, 1975." Paper presented at a meeting of the New York State Archaeological Association, May 1997.

Huey, Paul R. *A Preliminary Report on Rescue Excavations Near the Champlain Memorial Lighthouse and Site of the Grenadiers' Redoubt at Crown Point, 1978.* Waterford, New York: Bureau of Historic Sites, New York State Office of Parks, Recreation and Historic Preservation, Revised March 1995.

Huey, Paul R. "The History and Archaeology of Crown Point." *Fortress* Issue No. 5 (May 1990), 44-54.

Jelks, Dr. Edward B. *Archaeological Investigations at Constitution Island, United States Military Academy, West Point, New York, 1971.* West Point, New York: The West Point Fund, 1972.

John Milner Associates, Inc. *Preservation Plan, Redoubts No. 1 and 2 at the Stony Lonesome II Housing Facility, United States Military Academy, West Point, Orange County, New York.* U.S. Army Corps of Engineers, New York District: 1996.

Johnson, James M. "Defending the Hudson River, 1776-1777: A Warm Reception in the Hudson Highlands, October 1777." *Sea History* 98 (Autumn 2001), 11-13.

Jones, Gilbert S. *Valley Forge Park, An Historical Record and Guide Book.* Valley Forge Park Commission: 1947.

Kajencki, Francis Casimir. *Thaddeus Kosciuszko, Military Engineer of the American Revolution.* El Paso, Texas: Southwest Polonia Press, 1998.

Ketchum, Richard M. *Decisive Day, The Battle for Bunker Hill.* Garden City, New York: Doubleday & Company, 1974.

Kite, Elizabeth S. *Brigadier-General Louis Lebegue Duportail, Commandant of Engineers in The Continental Army, 1777-1783.* Baltimore: The Johns Hopkins Press; Philadelphia: The Dolphin Press; and London: Oxford University Press, 1933.

Koke, Richard J. "Forcing the Hudson River Passage, October 9, 1776." *The New York Historical Society Quarterly* XXXVI, No. 4 (October 1952), 458-466.

Koke, Richard J. "The Struggle for the Hudson: The British Naval Expedition Under Captain Hyde Parker and Captain James Wallace, July 12-August 18 1776." *The New York Historical Society Quarterly* XL, No. 2 (April 1956), 115-174.

Lacoursiere, Jacques. *The Battlefield, The Plains of Abraham, 1759-1760*. Sillery, Quebec, Canada: Septentrion, 2001.

Lane, William Coolidge. *A Catalogue of the Washington Collection in The Boston Athenaeum*. Boston: The Boston Athenaeum, 1897.

Lockhead, Ian C. *The Siege of Malta 1565*. London, England: Literary Services and Production Ltd, 1970.

McLaughlin, Scott Arthur. *History Told From the Depths of Lake Champlain: 1992-1993 Fort Ticonderoga-Mount Independence Submerged Cultural Resource Survey*. Ferrisburgh, Vermont: Lake Champlain Maritime Museum at Basin Harbor, 2000.

Mead, John "Jack." *Archaeological Survey of Fort Putnam and Other Revolutionary War Fortifications at West Point, New York, 1967-1968*. West Point, New York; West Point Museum Fund, 1968.

Miller, Charles E., Jr., Donald V. Lockey and Joseph Visconti, Jr. *Highland Fortress, The Fortification of West Point During the American Revolution, 1775-1783*. West Point, New York: Department of History, U.S. Military Academy, 1979.

Palmer, Dave R. *The River and the Rock*. New York: Greenwood Publishing Corporation, 1969.

Panamerican Consultants, Inc. *Maintenance Plan for Redoubts Nos. 1 and 2 and their Associated Batteries, U.S. Military Academy at West Point, Orange County, New York*. West Point, New York: U.S. Military Academy, May 2003.

Rees, John U. "'We...got ourselves cleverly settled for the night...' Soldier's Shelter on Campaign during the War for Independence: Part I." *Military Collector & Historian* 49, no. 3 (Fall 1997), 98-107. The following articles by Rees are an ongoing series that discusses temporary shelters used by the Continental and British Armies during the Revolutionary War.

Rees, John U. "'We...got ourselves cleverly settled for the night...' Soldier's Shelter on Campaign during the War for Independence: Part II." *Military Collector & Historian* 49, no. 4 (Winter 1997), 156-168.

Rees, John U. "'We...got ourselves cleverly settled for the night...' Soldier's Shelter on Campaign during the War for Independence: Part III." *Military Collector & Historian* 53, no. 4 (Winter 2001-2002), 161-168.

Rees, John U. "'They had built huts of bushes and leaves' Analysis of Continental Army Brush Shelter Use, 1775-1782." *The Brigade Dispatch, Journal of the Brigade of the American Revolution* XXXII, no. 3 (Autumn 2002), 7-10.

Riling, Joseph R. *The Art and Science of War in America, A Bibliography of American Military Imprints, 1690-1800*. Alexandria Bay, New York and Bloomfield, Ontario, Canada: Museum Restoration Service, 1990.

Sheffield, Merle G. *The Fort That Never Was, A Discussion of the Revolutionary War Fortifications Built on Constitution Island, 1775-1783*. West Point, New York: Constitution Island Association, 1969.

Simms, Jephtha R. *History of Schoharie County*. 1845. Accessed on-line at <http://www.rootsweb.com/~nyschoha/simms19.html> on February 25, 2004.

- Simms, Jephtha R. *The Frontiersmen of New York*. Albany, New York: 1883. Accessed on-line at <http://www.mohawkvalleyhistory.com/simmshudson.htm> on December 21, 2004.
- Smith, Samuel S. *Fight for the Delaware, 1777*. Monmouth Beach, New Jersey: Philip Freneau Press, 1970.
- Spaulding, Colonel Oliver L., Jr. "The Military Studies of George Washington." *The American Historical Review* XXIX, No. 4 (July 1924), 675-680.
- Stanley, John Henry. *Preliminary Investigation of Military Manuals of American Imprint Prior to 1800*. M.A. Thesis: Brown University, 1964.
- Steele, Ian K. *Fort William Henry & The Massacre*. New York and Oxford: Oxford University Press, 1990.
- Stowe, Gerald C. and Jack Weller. "Revolutionary West Point: 'The Key to the Continent.'" *Military Affairs* XIX, No. 2 (Summer 1955), 81-98.
- Stotz, Charles Morse. "Forbes Conquers the Wilderness: A Modern Odyssey." *Western Pennsylvania Historical Magazine* 67 (October 1984), 309-322.
- Syrett, David. "The British Landing at Havana: An Example of an Eighteenth-Century Combined Operation." *The Mariner's Mirror* 55 (1969), 325-331.
- Syrett, David. "The Methodology of British Amphibious Operations During the Seven Years and American Wars." *The Mariner's Mirror* 58 (1972), 269-280.
- Thomas, Harold A. "The Last Two Campsites of Forbes' Army." *Western Pennsylvania Historical Magazine* 46 (1963), 45-56.
- Thomas, Harold A., "Site of Forbes Last Three Breastworks." *Western Pennsylvania Historical Magazine* 47 (1964), 55-6.
- Ward, Christopher. *The War of the Revolution*. 2 volumes. New York: The Macmillan Company, 1952.
- Williams, Noel Saint John. *Redcoats Along the Hudson, The Struggle for North America, 1754-1763*. London and Washington: Brassey's, 1997.